THE IRON TRADE REVIEW

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THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The largest buying of pig iron in the week comes from the leading cast iron pipe interest. The scarcity of the lower grades usually sought for pipe work has led to the buying of intermediate grades, and the greater part of the 100,000 tons now under inquiry is reported to be No. 3, with a less tonnage of No. 2 foundry and No. 2 soft. It is understood that over 15,000 tons of the three grades named has been placed with one seller. Gray forge for early shipment is very scarce and a recent order for 2,000 tons could not be filled. At $17.50 Birmingham for the second half it is considered too high by the leading buyers, and these recent inquiries have resulted in nothing. In general, pig iron buying has been light in the past week, and there is no indication of an early change in the attitude of buyers. Freight blockades south of the Ohio River have been a retarding influence, and the coke troubles of Northern furnaces, while an old subject, are still the dominant feature of the situation in the Central West. When the added cost of irregular working, and of coke under the high-priced contracts of 1903, is figured and account taken of the probable advance in Lake Superior iron ores, furnaces are not disposed to press the matter of contracts for the latter part of the year. Both furnacemen and foundrymen are concerned over the high level of labor and material cost, and a further element that enjoins caution is the large advance insisted upon by the bituminous miners. The foreign situation both in pig iron and billets is a waiting one. In billets firmer conditions in the Central West and stronger ocean feights have advanced the price for the German product, $28 at New York being now asked. Some differences appear in domestic steel, a quotation of $29 at Kentucky mill being made, as against $30 at Ohio mill, while as high as $31 for Bessemer billets at an Ohio mill has been quoted. There is considerable inquiry for rods, but at $34.50 consumers find little encouragement to take hold. The independent sheet and tin plate manufacturers have made no definite move as yet. Negotiations for Virginia iron, either by furnace ownership or by term contract, are the latest phase. An interesting development in connection with independent companies is the probability that a Bessemer steel plant instead of open-hearth will be built at the Youngstown tube plant. The finished material market is quiet but generally firm. Leading bar iron manufacturers have changed the base from 1.80c Pittsburg to 1.80c Youngstown. This gives a Pittsburg and a Cleveland price of 1.84¾c and is rather more favorable to large consuming interests in Cleveland. The month shows a large tonnage closed in both iron and steel bars. Structural mills are making better deliveries and the prospect is that 1903 will not see as high premiums as were paid in 1902. Among the week's contracts of the American Bridge Co. is one for a 5,000-ton structure for the Worthington works at Harrison, N. J., and a railroad bridge order for 1,500 tons. The new Jones & Laughlin bridge at Pittsburg will require 8,000 tons. Sales of heavy melting stock amounting to 65,000 tons were made at Pittsburg, for the most part at $21.25.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
429 PARK BUILDING, JAN. 28.

The market, although more active in finished lines, continues quiet but strong in finished material. The current business in finished material is normal for this season of the year and there has been some further contracting on the part of agricultural implement manufacturers for steel bars. Large jobbers in steel bars are still holding off, however, owing to the refusal of the large manufacturers to grant them a concession of $2 per ton. A number of jobbing houses in the West had representatives in this district this week for the purpose of placing contracts with some of the smaller mills, but on account of the high price of billets these mills are in no position to grant any concessions; and unless the large producers grant the concession asked, which is unlikely, the jobbers will be compelled to buy from the mills at the same price that the large consumers pay and much of this large business which was heretofore placed through jobbers will come to the mills direct. The bar iron situation is very strong, the price having been slightly advanced and the new base is 1.80c, Youngstown, which is equivalent to 1.84¾c, Pittsburg. Eastern mills manufacturing muck iron and iron bars are not shipping any of their product into this market to any extent, as their output at present is very limited owing to the shortage of fuel and the tonnage turned out goes to supply the eastern trade.

Nothing of importance has developed in the negotiations now on between some of the independent sheet and tin plate manufacturers and the Clairton Steel Co. relative to the erection of a sheet bar mill at Clairton, although another meeting was held the latter part of last week with officials of the Clairton Steel Co. The independent sheet and tin plate manufacturers not interested in this Clairton deal have another scheme on foot in which they hope to interest all of the independent manufacturers of sheets and tin plate in the Middle West. It does not provide for the erection of a steel mill, but the purchase of a number of furnaces in Virginia and Kentucky to provide iron for the sheet mills to be taken into the proposed combination having their own steel plants. The steel mills operated, under erection and proposed by the independents and their affiliations would give them an output of approximately 400,000 tons a year, which would be almost sufficient to supply all the mills with the steel they require.

According to advices from Youngstown, O., the additional stock issued by the Youngstown Iron Sheet & Tube Co. will be taken by the present stockholders and the erection of a steel plant will be commenced at an early date. More than a year ago plans were prepared for six 50-ton open-hearth furnaces, but it is probable that instead a Bessemer plant will be erected.

Several days ago the National Tube Co. closed a conversion arrangement with the Republic Iron & Steel Co. whereby the latter is to roll 10,000 tons of narrow plates during the next six months, the National Tube Co. furnishing the steel. It will be furnished by the constituent companies of the United States Steel Corporation from Sharon and other mills.

PIG IRON.—The Bessemer pig iron market continues quiet

and firm. Small lots are sold for early deliveries at prices ranging from $22 to $22.25 at the furnace, while deliveries extending over the next six months are from $1 to $1.25 lower. For delivery through the last half of the year furnaces are asking $20.50. We note sales of small lots of foundry iron, No. 2, for delivery during the next two months, amounting to 2,500 tons at prices ranging from $22.25 to $23, Pittsburg. We also note the sale of 1,500 tons of forge iron for early delivery at $21.25, Pittsburg, and the sale of 2,000 tons for delivery in April and May at $21. No Southern iron is being bought in this market at present owing to the high freight rates and the quotations in the South which are higher than the quotations on Northern iron. The Jones & Laughlin Steel Co. has been selling Bessemer iron during the past week to some extent, taking advantage of the present high prices, as they have a surplus on hand owing to the heavy shipments they have been receiving from abroad on their contract calling for the delivery of 50,000 tons. We revise quotations as follows:

Bessemer, Valley	$21 00 to 22 00
Bessemer, Pittsburg	21 85 to 22 85
No. 1 Foundry	23 00 to 24 00
No. 2 Foundry	22 00 to 22 50
Gray Forge, Pittsburg	21 00 to 21 25
Chilled Basic, Valley	21 00 to 21 50
Chilled Basic, Pittsburg	21 85 to 22 35

STEEL.—Sales continue to be limited to small lots owing to the high prices asked for both Bessemer and open-hearth. Some Bessemer steel is being offered in this market on a basis of $31, Youngstown, while the Bessemer plant at Ashland, Ky., is holding its billets at $29 at mill. Open-hearth billets, ordinary specifications, are held at $31 at mill in this district. Some of the independent wire and wire nail manufacturers have come into the market in the past few days for a supply of rods and it is almost impossible to secure them except from the American Steel & Wire Co. The market is also somewhat firmer, both Bessemer and open-hearth being held at prices ranging from $34.50 to $35. There have been no sales of foreign steel during the week, German billets being held nominally at $30.50, Pittsburg.

SPELTER.—The market continues firm and prime Western grades are held at 4.92½c to 4.95c, Pittsburg.

FERRO-MANGANESE.—Domestic manganese is again being offered on the market, 80 percent being quoted at $50 per ton in carload lots at the furnace. For more than six months the largest producer of ferro has had none to offer, as several furnaces on ferro were placed on pig iron and only enough of the former was produced to supply the plants of the United States Steel Corporation. German manganese is quoted at $49 to $50, delivered at buyer's mill.

MUCK BAR.—The market continues very quiet and the few small sales made were on a basis of $33 to $33.25 at the mill, Pittsburg.

SKELP.—The demand continues limited and steel skelp is held at 1.95c for all sizes. Iron skelp is held at 2c to 2.10c, according to the widths.

RAILS AND TRACK MATERIAL.—There has been no heavy buying of rails, although the light rail market continues active. Prices for the latter are somewhat lower owing to the large number of mills competing for business. We revise quotations as follows: Standard sections, 50 pounds and over, in lots of 200 tons and over, $28; car lots and less than 200 tons, $30; less than car lots, $32; light rails, 8 pounds, $40; 12 pounds, $37.50 to $38; 16 pounds, $36 to $37; 20 pounds, $35; 25 to 40 pounds, $33 to $34. Track materials: Spikes, 2.15c to 2.25c; track bolts, square heads, 2.05c; hexagon heads, 2.65c; fish plates, 1.60c.

BARS.—A slight advance has been made in the price of iron bars and the large producers are now holding their product on a basis of 1.80c, Youngstown, equivalent to 1.84¾c, Pittsburg. The demand is good and we note sales amounting to 2,000 tons. The buying of steel bars is fairly large, but some heavy contracts would be placed if the mills would accede to the demands of the jobbers. We revise quotations as follows: Bessemer steel bars, 1.60c; open-hearth, 1.70c; plow beams and cultivator beams, 1.60c, net; channels, angles, zees and tees, Bessemer under 3 inches, 1.70c; over 3 inches, 1.80c; bar iron, 1.80c, Youngstown, or 1.84¾c, Pittsburg, with freight added to point of delivery. Hoops and bands are quoted at 1.90c, full extras, in 250-ton lots and over, and 2c in less than 250-ton lots.

PLATES.—The market continues firm and a fair amount of new business continues to be placed. Somewhat better shipments can now be had and several of the mills can make deliveries in two or three months. We quote as follows: Tank plates, ¼-inch thick and up to 100 inches in width, 1.60c at mill, Pittsburg; flange and boiler steel, 1.75c; marine, ordinary, fire-box, A. B. M. A. specifications, 1.80c; still bottom steel, 1.80c; locomotive fire-box, not less than 2.10c, and it ranges in price to 3c. Plate more than 100 inches wide, 5c extra 100 pounds. Plate 3-16 of an inch in thickness, $2 extra; gauges Nos. 7 and 8, $3 extra. These quotations are based on carload lots, with 5c extra a hundred pounds for less than carload lots. Terms, net cash, in 30 days.

STRUCTURAL MATERIAL.—Dealers in structural material are no longer able to secure large premiums for early shipment as the mills are now in position to make fairly prompt deliveries on nearly all sections. The new bridge which the Jones & Laughlin Steel Co. intends erecting across the Monongahela river will require about 8,000 tons of material and it will be rolled at the company's South Side plant. Quotations are as follows: Beams and channels, 3 to 15 inches, 1.60c; 18 to 24 inches, 1.70c; tees, 1.65c; zees, 1.60c; angles from 3 to 16 inches, 1.60c; universal mill plates, 1.60c.

PIPES AND TUBES.—New business in merchant pipe continues heavy and the mills of the National Tube Co. are operating in full to fill orders. Some of the independent concerns are cutting prices, despite the small differential existing between the cost of the raw material and the finished product. Prices on carload lots, plus the freight to destination, are as follows:

MERCHANT PIPE.

	Steel		Guaranteed Wrought Iron	
	Black Percent.	Galv. Percent.	Black Percent.	Galv. Percent.
⅛, ¼ and ⅜ inch	68	58	65	55
½ inch	70	60	67	57
¾ to 6 inch	75	65	72	62
7 to 12 inch	73	63	70	60
Plugged and Reamed				
1 to 4 inch	73	63	70	60
Cut 3 to 6 feet				
⅛, ¼ and ⅜ inch	63	52	60	49
½ inch	65	54	62	51
¾ to 6 inch	71	60	68	57
7 to 12 inch	69	57	65	54
Cut 6 feet and longer				
⅛, ¼ and ⅜ inch	64	53	61	50
½ inch	66	55	63	52
¾ to 6 inch	72	61	69	58
7 to 12 inch	70	58	66	55
Extra Strong Plain End				
⅛ to 8 inch	69	59	65	55

Threads only—Same as Plain End, plus 1¼ percent net.
Threads and Couplings—Same as Plain End, plus 2½ percent net.

Double Extra Strong Plain End				
½ to 8 inch	61	51	57	47

Threads only—Same as Plain End, plus 2 percent net.
Threads and Couplings—Same as Plain End, plus 8 percent net.

NOTE: Orders for less than carload will be charged at 12½ percent advance. Extra and Double Extra Strong Cut Lengths, lower random discounts by 10 percent net for 6 feet and longer, and 15 percent net for 3 to 6 feet.

BOILER TUBES.

Steel.

	Percent
1 to 1½ inches	45
2¼ to 5 inches	62½
1¾ to 2¼ and 6 to 13 inches	52½

Iron.

	Percent.
1 to 1½ inches	36½
2¼ to 5 inches	45½
1¾ to 2¼ and 6 to 13 inches	35½

CASING.

	S. and S. Percent.
2 to 3 inches	58
3½ to 4 inches	60
4½ to 12½ inches	63

SHEETS.—The demand for the lighter gauges continues to improve and the American Sheet Steel Co. continues to secure a fair volume of business. Independent manufacturers are at a disadvantage, however, on account of the low prices that are being quoted and many of them are unwilling to take business at prices quoted by the American Sheet Steel Co. The tin plate trade is now in a normal condition, the American Tin Plate Co. having 227 of its 264 mills in operation. Of the 78 independent tin plate plants, 40 are in operation. We quote black sheets in 500-bundle lots and over as follows: No. 28, 2.75c; No. 27, 2.65c; No. 26, 2.55c; Nos. 22 and 24, 2.45c; Nos. 18 and 20, 2.35c; Nos. 14 and 16, 2.25c; Nos. 10 and 12, 2.10c to 2.15c. Galvanized: No. 16, 2.60c; No. 18, 2.85c; No. 26,

3.35c; No. 27, 3.60c; No. 28, 3.85c; No. 29, 4.35c; No. 30, 4.50c.

WIRE AND WIRE NAILS.—The current business in wire and wire nails that is being received by the mills is not as heavy as it was a month ago when the buying was exceedingly large. The market is strong, however, and prices are being well maintained. We make the following quotations: Wire nails, carload lots, to jobbers f. o. b. cars, Pittsburg, $1.90; plain wire, carload lots, $1.80; barb wire, carload lots, $2.20; staples, carload lots, $2.10. Galvanizing, 30 cents extra. Carload lots to retailers are held at 5 cents advance in all lines, and on less than carload lots a further advance of 10 cents is charged. Steel cut nails are quoted as follows: Carload lots, $2.10, and less than carload lots, $2.15 f. o. b. Pittsburg, plus freight to point of destination. Iron cut nails are $2.20 in carload lots and $2.25 in less than carload lots. Terms, 60 days, less 2 percent off in 10 days.

MERCHANT STEEL.—Demand for the finer grades of steel continues strong and all the mills are carrying a comfortable tonnage on their books. We quote as follows: Turned cold rolled and ground shafting, 47 off in carload lots and 42 percent off in less than carload lots; tire steel, 2.15c to 2.25c; spring steel, 2.25c to 2.35c; toe calk, 2.30c to 2.40c. The following differentials maintain: Less than 2,000 pounds of a size and not less than 1,000 pounds, 10 cents advance; less than 1,000 pounds of a size, 30 cents advance. Tool steel is quoted 7 cents and upwards, according to the grade.

OLD MATERIAL.—We note the sale of 65,000 tons of heavy melting stock for delivery the remainder of the year at $21.25, gross ton, Pittsburg. Otherwise the market continues quiet and we revise quotations as follows, gross tons: Heavy melting stock, $21.50 to $22; low phosphorus melting stock, $25 to $25.50; steel rails, $21 to $21.25; re-rolling rails, No. 1 cast scrap, $18 to $18.50; borings, $11 to $11.50; busheling scrap, $17.50 to $18.50; old iron rails, $24.50 to $25; turnings, $15 to $15.50.

COKE.—Foundry coke for early shipment continues to be sold at prices ranging from $6.50 to $7, while for delivery through the second half of the year $5 is asked. Furnace coke for early delivery is held at $3.50 to $4 per ton. For the week ending Saturday, Jan. 17, the production of the upper Connellsville region amounted to 235,625 tons, which was a slight falling off as compared with the production of the previous week. The production of the lower region amounted to 48,400 tons, as compared with 48,910 tons the previous week.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
519 MONADNOCK BLOCK, Jan. 27.

The car and fuel shortage is again causing anxiety in this market. Blockades at points below the Ohio river have been frequent during the week, and shipments of pig iron have been considerably delayed. Many furnaces in this section are having much trouble, also, in securing cars, and a number report that they are accumulating stocks of iron in their yards. The furnace at Mayville, Wis., has been forced to bank because of the decreasing supply of coke, and other local stacks have such small stocks on hand that they are in doubt as to the extent of future operations. The market in the past week has been quiet, transactions being confined largely to finished material. There has been some buying of pig iron, but mostly in small lots for quick shipment. Bar iron and steel are active, and merchant pipe and boiler tubes have been moving briskly. There is a heavy demand for plates and wire products. Sheets and structural steel are quiet. Orders for heavy rails continue to be placed by electric roads for such deliveries as mills can give. The demand for light rails and track supplies is heavy. Inquiries for billets are frequent, though no sales of any magnitude are reported. Scrap iron is in better demand, but prices are considered too high for any heavy buying.

PIG IRON.—Little interest is shown by melters in covering for their future wants. Sales in the past week have been limited almost entirely to small lots for deliveries extending through the remainder of the first half of the year. This inactivity may be ascribed in a large measure to the fact that a majority of the foundrymen have covered for their requirements for the first half, and consequently are content to wait a few weeks longer for further developments before placing orders for the last six months. With the entry of a few large consumers sellers expect that buying will be stimulated. Two concerns, whose requirements run into large figures, are already sounding the market, having sent out inquiries for 1,500 and 2,000 tons respectively. This represents but a small portion of what they will purchase when ready, but is sufficient for them to get an idea as to the condition of furnaces. These and several other big buyers are expected to cover about March 1. Notwithstanding the action of leading Southern producers in fixing the price of No. 2 foundry for the last half at $18.50, there is some deviation from this basis. Sales of 800 tons of No. 1 soft, were made in the Birmingham market at $20, and 300 tons of No 2 foundry at $19, deliveries on both extending through the year. In the local market also established prices have been ignored, sales of No. 2 foundry having been made at $18 and above $18.50. A majority of the sellers, however, are still holding at the latter quotation. Charcoal iron has been in better demand during the past week, and standard Bessemer for quick shipment continues to be eagerly sought by malleable foundries. Southern furnaces are again complaining of a scarcity of cars and iron en route is considerably delayed on account of the frequent traffic blockades at points below the Ohio river. The condition of local furnaces is acute, owing to the fuel shortage. The Mayville furnace banked last week as a result of its inability to get coke, and others are reported to have only small stocks on hand. The Calumet furnace expects to go in blast this week, after being idle for some time. We quite as follows:

Lake Superior Charcoal	$26 50 to 27 50
Local Coke Foundry No. 1	23 50 to 25 50
Local Coke Foundry No. 2	23 00 to 25 00
Local Coke Foundry No. 3	23 50 to 24 50
Local Scotch Foundry No. 1	24 00 to 25 50
Southern Coke No. 1	22 85 to 23 35
Southern Coke No. 2	22 35 to 22 85
Southern Coke No. 3	21 85 to 22 35
Southern Coke No. 4	21 35 to 21 85
Southern No. 1, soft	22 85 to 23 35
Southern No. 2 soft	22 35 to 22 85
Southern Gray Forge	21 35 to 21 85
Southern Silveries (according to silicon)	26 15 to 28 15
Jackson Co. Silveries, 6 to 8 percent silicon	32 20 to 33 20
Ohio Strong Softeners	26 30 to 26 80
Alabama and Georgia Car Wheel	27 35 to 28 35
Malleable Bessemer	23 50 to 24 50
Standard Bessemer	24 00 to 24 50

BARS.—All the mills report a heavy demand for iron and steel bars. Railroads, car builders and implement manufacturers are the chief purchasers though every other branch of the consuming trade is represented in the buying movement. Specifications are also in good volume and for all sizes. Some desirable business was taken during the week at 1.75c, Chicago, though the minimum quotation generally is 1.80c. One seller reports that it will this week advance its minium quotation to 1.85c. We quote mill shipments, Chicago delivery, Bessemer steel, 1.76½c; angles, less than 3x3, 1.86½c base; hoops, in lots of 250 tons and greater, 2.06½c base; less than this amount, 2.16½c; iron, 1.75c to 1.80c. Store prices are as follows: Steel 2c to 2.10c; iron, 2.15c to 2.20c; hoops, 2.40c to 2.50c; angles, 2.25c to 2.50c rates.

SHEETS.—There is a fair demand in small lots for both black and galvanized sheets. Store trade is reported active. We quote No. 27 black, 2.76½c to 2.81½c; galvanized, 3.35c to 3.45c. For deliveries from stock, No. 27 black, 2.95c to 3c; galvanized, 75 percent to 75 and 5 percent.

STRUCTURAL STEEL.—Mill transactions in the week have been quiet, though the movement from warehouses has been brisk. We quote mill prices, Chicago delivery: Beams, 15 inches, and under, 1.75c to 2c; 18 inches and over, 1.85c to 2.10c; universal plates, 1.75c to 2c; angles, channels and tees, 1.85c to 2c base. The maximum quotation represents the price for quick delivery. On lots from store cut to length, we quote 2¼c to 2½c per pound.

PLATES.—Sales by mills during the past week aggregated several thousand tons, all for delivery in the last half. There is a heavy volume of inquiries, but mills are accepting at the present time only such orders as they care to fill. We quote mill shipments, Chicago delivery, as follows: Tank steel, ¼ inch and heavier, 1.75c to 2c base; flange steel, 1.85c to 2c base. Prices from stock, tank steel, ¼ inch and heavier, 2.25c to 2.35c; 3-16, 2.25c to 2.40c; Nos. 8 and 10, 2.40c to 2.50c; flange steel, 2.50c to 2.60c.

RAILS AND TRACK SUPPLIES.—The demand for light rails and

track supplies has been heavy and mills are sold for several weeks ahead. There has also been some inquiry from electric roads for standard sections, and several orders for small tonnages have been placed for such deliveries as can be made. We quote standard sections, $28; second quality, $27; light rails, 45 pounds, $34 to $35; 12 pounds, $40 to $41, with regular differentials for intermediate sizes. Track supplies, mill shipments, are quoted as follows: Angle bars, 2c to 2.10c; spikes, first quality, 2.25c (out of store, 2.40c to 2.50c rates); second quality, 2.15c; track bolts, 3½x¾ with square nuts, 2.85c to 3c per 100 pounds; with hexagon nuts, 3.05c to 3.15c with usual differentials for other sizes.

MERCHANT STEEL.—New business is of light proportions, though the weekly specifications are large. We quote mill shipments, Chicago delivery, as follows: Spring steel, 2.65c to 2.75c; sleigh shoe, 1.95c, flat sizes; concave and convex, 2c; out of store, 2.15c; cutter shoe, 2.50c to 2.60c; machinery steel, 2.15c to 2.25c; base; plow steel, 2.50c and upwards, according to quality; toe calk, 2.30c to 2.40c; out of stock, 3c to 3.10c; ordinary tool steel, 6c to 7c; specials, 13c and upwards less than carload lots, 5 to 10 percent higher; cold rolled shafting, carload lots, 47 percent off; less than carload lots, 42 percent off.

MERCHANT PIPE.—Buying continues to be very heavy, jobbers having come into the market for their spring requirements. Independent mills are cutting the quotations of the leading producer on wrought iron pipe. We quote prices to jobbers, f. o. b. Chicago, carload lots, as follows:

RANDOM LENGTHS.

	Black.	Galv.
⅛, ¼ and ¾, inclusive	67.35	57.35
½	69.35	59.35
¾ to 6 in., inclusive	74.35	64.35
6 to 12 in., inclusive	72.35	62.35

Less than carload lots, 12½ percent advance.

Less than carload lots, 12½ percent advance.

Jobbers' discounts to consumers f. o. b., Chicago are as follows:

	L. W. Steel Percent.	C. C. Iron Percent.
⅛, ¼, ¾ in.	66⅔ net	56⅔ net
½ in.	68⅔ net	58⅔ net
2¾ to 5 in.	60.85	45.85
6 to 13 in.	55.85	35.85

BOILER TUBES.—There is no diminution in the demand, jobbers and consumers all covering for their spring requirements. We quote carload lots, mill shipments, as follows:

	L. W. Steel Percent.	C. C. Iron Percent.
1 to 1½ in.	35	35
1¾ to 2½ in.	47½	32½
2¾ to 5 in.	55	42½
6 to 13 in.	47½	32½

CAST IRON PIPE.—A good business has been done in the past week, orders from railroads for 2,000 tons, from St. Paul for 1,000 tons and from Cincinnati for 1,000 tons, having been received. The general trade has also been of fair proportions. We quote f. o. b. Chicago, 4-inch water pipe, $34; 6-inch, $33; 8-inch and upwards, $32; gas pipe, $1 a ton higher.

BILLETS AND WIRE RODS.—Inquiry for both products represents a good sized tonnage, though actual sales are not large. We quote rods, $37.50; Bessemer billets, $31; small lots from stock, 4x4, $40; open-hearth billets for forging purposes, $37 to $39; for use in rolling mills, $32.50 to $33. German basic Bessemer billets are offered at $27 to $27.50, Atlantic ports, duty paid, for round lots—5,000 tons and upwards—of one size and one carbon. Special carbons are higher, according to specifications and tonnage.

WIRE NAILS, FENCING, ETC.—There is an exceptionally strong demand for wire nails, the entire production of local producers going into immediate consumption. Inquiries from the horse shoe trade are coming in indicating a buying movement in this product in the near future. Barb wire and fencing are in active demand. We quote prices to jobbers, Chicago delivery, as follows: Plain wire, carloads, $2; smaller lots, $2.10; galvanized, $2.30 in carloads, and $2.40 smaller lots; Barb wire is $2.40 in carloads, and $2.50 in less than carloads; galvanized, $2.70 in carloads, and $2.80 in lesser lots. Staples, are $2.20 carloads, and $2.35 smaller lots. Wire nails, $2.10 carloads, and $2.20 smaller quantities; cut nails $2.10 to $2.15 carloads, and $2.20 to $2.25 less than carload lots. Poultry netting to jobbers, 85 and 5 percent discount from list f. o. b. Joliet or DeKalb, with actual freight allowed not exceeding 50 cents per 100 pounds; to retailers, 80 and 20 percent off.

COKE.—There is a pronounced scarcity of coke in this market, and fuel on track brings from $10 to $10.50. For future delivery, $5 to $5.50 at the ovens is the general quotation.

OLD MATERIAL.—There has been a better demand during the week, though prices are still too high for any active buying movement. We quote as follows, gross tons:

Old iron rails	$23 50 to 24 00
Old steel rails (mixed lengths)	18 00 to 18 50
Old steel rails (long lengths)	23 00 to 23 50
Relaying rails	31 50 to 32 00
Old wheels	23 00 to 23 50
Heavy melting steel	17 50 to 18 00
Mixed country steel	15 00 to 15 50

The following are selling prices per net ton:

No. 1 R. R. wrought	$19 50 to 20 00
No. 2 R. R. wrought	18 00 to 18 50
Shafting	19 00 to 19 50
Dealers' forge No. 1	16 50 to 17 00
No. 1 busheling and wrought pipe	14 00 to 14 50
No. 1 cast	16 50 to 17 00
Railway malleable	15 50 to 16 00
Country malleable	14 50 to 15 00
Iron axles	23 50 to 24 00
Steel axles	19 50 to 20 00
Cast borings	10 00 to 10 50
Mixed borings, etc.	9 50 to 10 00
Wrought turnings	13 50 to 14 00
Machine shop turnings	13 00 to 13 50
Iron axle turnings	14 00 to 14 50
Steel axle turnings	13 50 to 14 00
Stove plate and light cast scrap	12 50 to 13 00
Old iron splice bars	21 00 to 21 50

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
1064 ROSE BUILDING, Jan. 28.

The Pennsylvania railroad on Monday resumed hauling ore from docks, but otherwise railroad conditions show no improvement. Buyers in pig iron and in other lines are still hesitating, but there are as yet no indications that prices will be lower in the next few months. If the agreement concerning bar iron, noted below, shall continue for some time, it may have the effect of increasing confidence in the strength of the situation.

IRON ORE.—No action has yet been taken as to prices, but discussion has been carried on freely and informally during the week. The position of the United States Steel Corporation is understood to be that, as it will not sell ore except to its constituent companies, it will not take an active part in fixing prices, but will abide by those decided upon for merchant mines, provided they are not unreasonably high. The talk within a few days has been strongly in favor of higher prices, the sentiment in some cases favoring an advance of about 75 cents for Mesabi ores and from 25 to 50 cents for old range Bessemers. It is not yet known whether there will be any agreement on non-Bessemers. No action as to prices of any kind of ores will be taken until the compilation of statistics concerning probable demand of furnaces has been completed. Those who advocate advances hold that, excepting the furnaces of the United States Steel Corporation, whose policy appears to be to carry stocks of ore considerably in excess of the needs of the months that remain of the closed season, there is not an unusually large supply of ore in furnace yards.

COKE.—Delivery does not improve. The prevailing price for foundry coke for the first half is $5.75 and $8 for spot.

PIG IRON.—Inquiries for delivery extending through the year are being received, but buyers are not showing a disposition to make contracts and sales are neither large nor numerous. Southern gray forge is held at $17.50 at the furnace and is hard to get. For delivery beginning next month $20, Birmingham, has been paid for No. 2 Southern, while for delivery during the first half the market is $18.50 at furnace, or $22.85, Cleveland. We quote domestic irons as follows, f. o. b. Cleveland, for shipments in the first half of 1903:

Bessemer	$21 75 to 22 25
No. 1 Strong Foundry	23 00 to 23 50
No. 2 Strong Foundry	22 50 to 23 00
No. 3 Foundry	21 75 to 22 25
Scotch No. 1	23 00 to 23 50
Scotch No. 2	22 50 to 23 00
Gray Forge, Valley	20 00 to 20 25
Lake Superior charcoal	26 50 to 27 50

FINISHED MATERIAL.—The feature of the week is the agreement of the principal producers of bar iron to sell on a basis of 1.80c Youngstown, which would make the Cleveland and Pittsburg price 1.84¾c. The change from Pittsburg to Youngs-

town as a base is made on the ground that the latter city is the great center for the rolling of bar iron. The change will be favorable to Cleveland consumers. For several months the bar iron business has been in a very unsatisfactory condition and there has been lively competition between the two principal producers on the one hand and the smaller companies, especially those west of Ohio, on the other. Whether the new price can be maintained, is, of course, not certain but indications are that there will be a determined effort to do so. Some sales have already been made at the new rate. Very fair business is being done in steel bars at 1.60c for Bessemer and 1.70c for open-hearth, Pittsburg. Agreement quotations on structural material are as follows: Beams and channels, 3 to 15 inches, 1.70c; 18 to 24 inches, 1.80c; tees, 1.75c; zees, 1.70c; angles from 3 to 6 inches, 1.70c; universal mill plates, 1.70c. The outlook is that demands of builders for structural material will not be as heavy as they were last year. The sheet situation has improved. Cutting is not so much in evidence, but sales are not brisk. The prices of the distributors of the product of the principal producer, are as follows: For 3-16-inch sheets and heavier, 2.15c, Cleveland. Mill sales of black sheets, Cleveland, to consumers: No. 24, 2.65c to 2.75c; No. 26, 2.75c to 2.85c; No. 27, 2.85c to 2.95c; and the following prices out of stock: No. 10, 2.35c to 2.50c; No. 12, 2.45c to 2.60c; No. 14, 2.50c to 2.60c; No. 16, 2.55c to 2.70c; Nos. 18-20, 2.75c to 2.90c; Nos. 22-24, 2.85c to 3c; Nos. 25-26, 2.95c to 3.10c; No. 27, 3.05c to 3.20c; No. 28, 3.15c to 3.30c. On galvanized sheets we quote mill sales in carload lots, Cleveland, as follows: Nos. 10 and 11, 2.60c; Nos. 12-14, 2.70c to 2.85c; Nos. 18-21, 3c to 3.15c; Nos. 22-24, 3.30c to 3.45c; Nos. 25-26, 3.55c to 3.70c; No. 27, 3.80c to 3.95c; No. 28, 4.05c to 4.20c; No. 29, 4.45c to 4.60c; No. 30, 4.95c to 5.10c. Galvanized sheets out of stock are quoted at 75 and 2½ off.

OLD MATERIAL.—The advance in price of bar iron is expected to benefit the scrap dealers, but as yet the effect is not evident. The market is quiet, the prices are firm. We quote Cleveland prices, all gross tons, as follows:

Old iron rails	$24 00 to 24 50
Old steel rails (over 6 feet)	22 00 to 23 00
Old steel rails (6 feet and under)	21 00 to 22 00
Old car wheels	23 00 to 24 00
No. 1 R. R. wrought scrap	20 00 to 21 00
Mill scrap	19 00 to 19 50
No. 1 machine cast scrap	21 00 to 21 50
Iron axles	29 00 to 30 00
Steel axles	28 00 to 29 00
Axle turnings	18 00 to 19 00
Wrought turnings (free from cast)	16 00 to 17 00
Cast borings	11 00 to 12 00
Uncut wrought iron boilers	12 00 to 13 00
Steel boiler plates	17 00 to 18 00
Grate bars	12 00 to 13 00
Pipes and flues (clean)	17 50 to 18 50
Tank iron	17 00 to 18 00
Hoop and band iron	13 50 to 14 50
Sheet iron	12 00 to 13 00
Wrought drillings	15 50 to 16 50
Malleable iron (railroad)	20 50 to 21 50
Malleable iron (agricultural)	17 50 to 18 00
Stove plate	16 00 to 17 00
Heavy steel	19 00 to 19 50

CINCINNATI.

Jan. 27

No important changes have taken place in the iron trade situation the past week. The coke market continues strong with foundry coke quotable at $7 to $7.50 for quick shipment f. o. b. ovens. Deliveries on contracts are becoming more difficult to obtain as railroads seem to be unable to move the tonnage offered. The pig iron market has been quiet. In finished material there is a good retailing demand. Old material is steady and unchanged.

PIG IRON.—The market continues in the same irregular condition as a week ago with no change in quotations, as maximum and minimum prices are the same as for the past ten days. The feature of the market is its quiet appearance. The buying is still confined to orders for spot or quick shipment iron, but trade of this character was perhaps smaller than in any week since the lessening demand for iron began. Sellers have not attempted to stimulate demand by shading prices and the market has held steady. It is said that buyers are disposed to cover only current needs for the present under the influence of three phases of the situation: the belief that pig iron will not advance and that nothing will be lost by waiting, the uncertainty of deliveries of coke and the high prices prevailing for fuel, and the irregularity or unstable condition of the market for the lighter forms of finished material. In No 2 foundry spot for quick shipment business is mostly at $18.50 to $19 Birmingham. The gray forge market is still attracting considerable attention, but offerings are mainly at $17 to $17.50 with bids at $16 Birmingham. This puts buyers and sellers so far apart that there is not much trading. It is trade talk that some sales have been made in the St. Louis territory at prices below $16 Birmingham. The persistent refusal of buyers of low grade iron to accept current asking prices in the face of the recent heavy inquiries seems to indicate that they are not in immediate need of supplies. We quote for quick delivery and first quarter of 1902, f. o. b. Cincinnati:

Southern Foundry No. 1	$22 50 to 23 50
Southern Foundry No. 2	22 00 to 22 50
Southern Foundry No. 3	20 75 to 21 25
Southern Foundry No. 4	19 75 to 20 75
Southern Foundry No. 1, soft	22 50 to 23 50
Southern Foundry No. 2, soft	22 00 to 22 50
Gray Forge	19 75 to 20 75
Northern Foundry No. 1	25 15 to 25 65
Northern Foundry No. 2	24 15 to 24 65
Southern car wheel iron	27 75 to 28 75

FINISHED MATERIAL.—The demand continues fairly good, although the business is mostly confined to small orders covering current needs. The total volume of this class of trading has been sufficient to impart a steadier tone to the market. While quotations are not fully maintained on all lines there seems to be a feeling that under increased demand values will be better sustained. This applies more particularly to the bar iron situation. In wrought pipe independent mills are still underquoting the leading interest sufficiently to unsteady the market, and there is a fairly good demand, although the irregularity in quotations has retarded some buyers from coming into the market. Heavy plates continue firm. Structural steel is quiet. We quote black sheets No. 27 at 2.75c in car lots of 500 bundles. Black sheets out of store are selling as follows: No. 28, 3.20c; No. 27, 3.10c; No. 16, 2.75c; No. 14, 2.65c; No. 12, 2.55c; No. 10, 2.45c. Galvanized sheets, car lots, sell at 75 and 10 percent off; less than car lots, 70 and 10 percent off. Tank plates out of store are quoted at 2.25c for ¼-inch and 2.35c for 3-16-inch. Prices for bar iron in carload lots are: 1.80c base, half extras f. o. b. Cincinnati; steel bars, 1.72c base, half extras f. o. b. Cincinnati. Both are retailed at 2c base, half extras, out of store. Beams and channels are quoted at 2¼c to 2¾c, from stock, and angles at 2.15c to 2.25c for base sizes. Merchant pipe and boiler types are quoted as follows for carload lots f. o. b. Cincinnati:

MERCHANT PIPE.
(Basing discounts.)

	Steel Pipe. Black. Percent.	Steel Pipe. Galv. Percent.	Guaranteed Wrought Iron Pipe. Black. Percent.	Guaranteed Wrought Iron Pipe. Galv. Percent.
⅛, ¼, ⅜-inch	66.8	56.8	63.8	53.8
½-inch	68.8	58.8	65.8	55.8
¾ to 6-inch, inclusive	73.8	63.8	70.8	60.8
7 to 12-inch, inclusive	71.8	61.8	68.8	58.8

BOILER TUBES.

	Steel Percent.	Iron Percent.
1 to 1½ in	43.8 & 5	38.8 & 5
1¾ to 2½ in	56.3 & 5	36.3 & 5
2¾ to 5 in	61.3 & 5	46.3 & 5
6 to 13 in	56.3 & 5	36.3 & 5

OLD MATERIAL.—The market holds steady with a fairly good demand and ample supplies for the wants. There is more movement than for several weeks past and prices are well maintained with no change in quotations. We quote:

Old No. 1 wrought railroad, net tons	$19 50 to 20 00
Cast machine and foundry, net tons	16 50 to 17 00
Old iron rails, gross tons	22 50 to 23 00
Old steel rails, gross tons	21 50 to 22 00
Old short lengths, gross tons	17 50 to 18 00
Old iron axles, net tons	26 00 to 27 00
Old chilled car wheels, gross tons	21 50 to 22 00
Stove plate, net tons	11 50 to 12 00
Wrought turnings, net tons	15 00 to 15 50
Cast borings, net tons	12 00 to 12 50

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1909, NO. 150 NASSAU ST., Jan. 27.

PIG IRON.—No appreciable change can be noted in the local pig iron market, from that previously described. Inquiries are numerous, but judging from the actual sales made, it would seem as if they were intended more to "sound" producers than anything else. The rumor is expressed, particularly by sales

agents, that if makers showed any disposition to shade prices melters would respond with some good sized orders. Unless something like this occurs, it is thought that the market will continue to drag along in the same listless fashion as for weeks past. Belated deliveries on old contracts seem to be the chief concern of melters hereabouts, and we know of several cases where purchasers have been disappointed in their expected shipments, and forced to go out into the open market. Spot iron is nearly as scarce and as dear as at any time during the past year. A few weeks ago the premiums it ordinarily commanded were thought to be on the wane, but recent reports put them as high as before. The supply of coke forms a more aggravating feature now than at any time. Prices at the ovens show no decrease from the high level that has prevailed for weeks past, and we know of some sales agents of pig iron who are kept busy trying to supply their customers in this direction, but with only small success.

There is nothing new to report in foreign irons. The cables and mails are kept busy describing the condition of affairs in this country, foreign producers believing that the market has reached a point where important developments are imminent. One foreign producer, writing to his representative here, says: "As we understand it, consumers are holding out for lower prices, but makers apparently will not make any concessions. Either they must, or consumers must look to us for their material." This is a diagnosis of the market which is shared in on all sides. Middlesboro No. 3 continues to be in good demand, and it is doubtful if a cargo lot could be purchased for less than $18, New York delivery, duty paid. The stiffening in price is not due to higher freight rates, under the influence exerted by foreign coal shipments. These, however, have not been very heavy at any Atlantic seaport, with the exception of Boston. German irons find a ready sale at about $20, especially among consumers who have hitherto used Southern No. 2 foundry, and who find German iron a good substitute, as well as some $4 cheaper per ton when delivery in this vicinity is made. Scotch irons are a shade weaker, an excellent brand of No. 1 being obtainable at $21.50 per ton, New York delivery, duty paid, if not a trifle lower. We quote: No. 1 X Northern, $23.25 to $24.25; No. 2 X, $22 to $22.75; No. 2 plain, $21 to $21.75; Southern No. 1 foundry, $23 to $23.50; No. 2 foundry, $22 to $22.50; No. 3 foundry, $21.50 to $22; No. 4 foundry, $20.50 to $21.

Billets.—Prices for both Bessemer basic and open-hearth German billets rule strong at $28 and $29, for large lots, New York delivery, duty paid. From negotiations known to be in progress, some excellent orders are a probability of the near future.

Rails.—For light and medium rails a particularly good demand is reported. Small orders, aggregating good totals, form the current business.

Finished Iron and Steel.—Compared with last week, a slight falling off in some lines is noticed. Structural orders represent a good tonnage. Important contracts closed during the week by the American Bridge Co. include about 5,000 tons for the new shops of Henry R. Worthington, one of the constituent concerns of the International Steam Pump Co., is building at Harrison, N. J.; and 1,500 tons from the Delaware & Hudson Railroad Co., for bridge purposes on its lines in Northern New York and Vermont. In plates, producers seem more inclined to refuse than seek orders, and have reached a point where only favored customers are considered. The only orders welcomed are those which call for delivery toward the close of the year. Sheets, while showing a firmer undertone than a few weeks ago, are still far from possessing features that auger a healthy trade. The demand is not considered what it should be, even for this time of the year. In bars, jobbers are disposing of their surplus stocks, at a trifle less than quoted figures, but generally speaking the latter are well maintained. New York prices are as follows: Beams and channels, 15 inches and under, 1.75c to 1.90c; angles, 3 to 6 inches, 1.75c to 1.90c; zees, 1.75c to 1.90c; bulb angles, 2.05c to 2.35c; deck beams, 2.05c to 2.25c; sheared steel plates, tank, 2.10c to 2.15c; flange, 2.25c to 2.30c; fire box, 2.30c to 2.50c; refined iron bars, 1.95c to 2c; soft steel bars, 1.95c to 2.10c; steel sheets, in carloads, New York, No. 28 black, 3.05c to 3.10c; galvanized, 75 and 7½ off.

PHILADELPHIA.

Jan. 27.

The volume of business has been fairly good and there is no evidence of weakening. Output is still restricted by scarcity of fuel. The general feeling is that business will soon be active at prices not lower than the present.

Pig Iron.—There are no changes of importance. The supply of coal and coke and foreign imports will have an important influence in determining the course of the market, but it is impossible to estimate what the railroads will be able to do or to say what imports will be. The advances of ocean freights has increased the cost of foreign iron about 50 cents, but there is still a comfortable margin for importations. Sales this week have been moderate and prices about as quoted last week, but for deliveries in six to nine months prices are slightly easier. Foreign iron is firmer. We quote as follows: No. 1 X foundry, $23.50 to $24; No. 2 X foundry, $22.25 to $22.75; No. 2 plain, $21.50 to $22; gray forge, $20.50 to $21; Middlesboro No. 3, $21 to $21.50; Scotch, $22.50 to $23.50.

Finished Material.—The market is strong. Output has been small, as the supply of coal has not been more than half of what the mills required to keep them in full operation. If these conditions continue, material will be selling at a premium similar to that of last year. Higher prices are already being demanded for immediate shipment, but reasonably prompt shipment is being guaranteed without asking higher prices than have prevailed for several weeks. Bar iron manufacturers have decided to make no change in prices. We quote as follows: Plates, small lots, 2.10c to 2.15c; carload lots, ¼-inch and thicker, 2c to 2.05c; universals, 2c to 2.05c; flanges, 2.10c to 2.20c; firebox, 2.25c to 2.30c; marine, 2.30c to 2.35c. Steel bars, 1.80c to 1.90c; prompt shipments from local mills; Western steel, 1.75c to 1.80c; bar iron, 1.92c to 1.95c, for carload lot as minimum quantity. Structural material in small sizes is quoted at 1.73½c to 1.80c; large sizes, all the way from 1.90c to 2.10c.

Old Material.—The market is dull and to make sales in quantity holders would probably make concessions. We quote as follows: Old steel rails, $20.75 to $21.25; miscellaneous heavy steel scrap, $20.25 to $20.75; low phosphorus scrap, $26.50 to $27.50; old steel axles, $25.50 to $26.50; old iron axles, $28.50 to $29.50; old iron rails, $23.50 to $24; old car wheels, $21 to $22; choice scrap R. R. No. 1 wrought, $22.50 to $23.50; country scrap, $20 to $21; machinery cast, $19.50 to $20.50; No. 2 light scrap (forge), $18 to $18.50; No. 2 light scrap (ordinary), $14 to $15; wrought turnings, $15.50 to $16.50; wrought turnings, choice heavy, $16.75 to $17; cast borings, $10.25 to $10.50; stove plate, $15 to $16.

BIRMINGHAM, ALA.

Jan. 27.

It is difficult to arrive at an accurate conclusion as to the iron market. It is currently reported that during the past week a good lot of No. 2 foundry iron sold at $18 f. o. b. Birmingham, whereas with others the ruling price is about $20. For some two or three weeks No. 1 foundry and No. 1 soft have been near the same level of prices as No. 2 foundry, owing to the fact that the furnaces generally have been very much behind on the latter grade, and do not as a rule sell the higher grades in advance of their make. As past due orders are cleaned up, there has been an appreciable slackening in the demand for these higher grades, which have for the past several months commanded a fancy price, owing to inability of consumers to secure iron on their contracts. It is known that Southern makers are making at least a dollar's difference in the price to the Pittsburg and Eastern markets as compared with the West and Central West. The low priced gray forge has disappeared, and no sales can be learned of recently on a lower basis than $17.50 Birmingham. It is well known that since resumption of work after the holidays, very little forge or mill iron has been produced, and in the meantime some large consumers of Southern forge iron have yet to cover their wants. Under these conditions, mill iron remains firm, and there is no indication now of any great concession in the price of the higher grades.

Leading charcoal iron interests seem to have taken

all the orders they wish just now for deliveries during the remainder of this year. It is understood $25 is being asked, deliveries over the last half of the year.

The supply of coke seems better than for some months. Some new ovens are going in commission, and with some improvements in transportation facilities, nearly all the furnaces report themselves as being able to keep pretty well supplied. The foundries are not yet quite so fortunate, but it is generally believed that in sixty days the local demand will be well cared for at materially lower prices than named at present—$6 to $6.50, f. o. b. cars at ovens.

Coal continues in very active demand. A cargo of Alabama coal is on its way to Boston, having moved the past week from Pensacola. An offer of quite a lot of coal has been made to the cities of New York and Chicago by some of the local coal companies through the mayor of Birmingham, and plans are now being perfected for the transportation of 25 cars to Chicago. A number of coal mines are yet unable to run full time, where marketing their entire output, by reason of continued scarcity of coal cars. The price for good run-of-mine coal continues to range around $1.75 at the mines.

Capt. J. W. Woolfolk has resigned as general manager of the Woodstock Iron Works, operating two furnaces at Anniston, Ala. It is announced that he will be succeeded by P. Murphy, from Tennessee. One of the Woodstock furnaces was just recently blown in, having been thoroughly overhauled and equipped with modern filling device and other labor saving arrangements.

The Metal Market.

CHICAGO.

OFFICE OF *The Iron Trade Review*, 519 MONADNOCK BLOCK, Jan. 27.

All metals are in active demand. Prices are firm and without change. We quote jobbers' prices as follows: Lake copper, carload lots, 12½c to 12¾c; less than carload lots, 13¼c to 13½c. Pig tin, 31c; pig lead, carload lots, 4.10c; less than carload lots, 4½c. Sheet zinc, carload lots, 6¼c, and 6⅛ in lots of 600 pounds. Spelter, carload lots, 4⅞c; less than carload lots, 5½c. Antimony, 10¾c to 11c for Cookson's, and 9¾c for Hallett's in small quantities. Nickel, 5c to 6c, according to quantity. Selling prices of old metals are as follows: Copper wire, $10.50; heavy copper, $10.50; light copper, $9.50; red brass, $10.50; yellow brass, $7.75; light brass, $6.50; lead pipe, 3½c; zinc, 3c to 3¼c.

NEW YORK.

OFFICE OF *The Iron Trade Review*, ROOM NO. 1909, 150 NASSAU ST., Jan. 27.

PIG TIN.—The pig tin market developed great strength during the week, and latest quotations represent the highest prices since the upward movement began. Compared with this time a week ago, prices show a net advance of about 100 points. The boom owes its origin and development to speculative interests alone, who declare that the present year will find consumption considerably larger than production. In immediate trade circles, this statement is discounted, and the opinion is expressed that there is no reliable data available upon which to base it. That the general condition of business does not warrant the latest advance in prices, is freely urged, since the majority of reports record the demand as exceedingly light, and the tendency in buying taking the form of one ton lots, where five ton lots was heretofore the rule. Interest in the local market is centered in the Banca auction sale on Thursday next, when 59,900 slabs will be disposed of, and the prices realized will undoubtedly have some effect on the immediate future of the market. The London market during the week shows an advance of over $3 since our last writing, and a firm undertone has characterized it throughout. Closing prices today at the Metal Exchange were as follows: Spot, 29.05c to 29.25c; January to May, 29.00c to 29.25c. London's closings follow: Spot, £132 7s 6d; futures, £132 10s. Arrivals at Atlantic seaports for the month to date amount to 2,545 tons, with 2,680 tons afloat.

COPPER.—On the whole, prices are about the same as those noted in our last report. Business was slightly better than it has been, although from Wall St. reports the impression might prevail that a decided buying movement had set in, which is far from being the case. During the week, authoritative confirmation was given to the report in our last letter, that two of the leading interests will not contribute any more statistics to the Copper Producers' Association. These are the Amalgamated and United Metals Selling Companies, whose combined output forms two-fifths of the copper production of the United States. As a result, the trade believes that copper production will be a matter of conjecture in the future, with prices perhaps conforming more to Wall St. than trade standards. The London market during the week was stronger, and latest prices much higher than a week ago. Closing prices at the Metal Exchange today were as follows: Lake, 12⅜c to 12⅝c; electrolytic, 12.30c to 12.50c; casting, 12.15c to 12.35c; standard, 11⅞c nominal. London's closings follow: Spot, £54 2s 6d; futures, £54 7s 6d. Exports for the month to date aggregate 6,931 tons, and present indications are that for the entire month they will fall some 7,000 tons compared with January of last year.

LEAD.—Without change here, lots of 50 tons or more selling at 4.12½c. St. Louis is slightly firmer at 3.97½c to 4.00c. London is a shade lower at £11 7s 6d. The proposed lead combination is practically completed, but no change is observable in the situation as a consequence.

SPELTER.—The market has been quiet, and values are a little easier, spot being quoted at 4.90c to 5.00c. St. Louis unchanged at 4.80c. London is a shade higher at £20 5s.

ANTIMONY.—The market here was without change, Cookson's being 8½c to 8¾c; Hallett's, 7c to 7¼c; and other brands, 6¾c to 7c.

NICKEL.—Large lots can be had at from 40c to 50c, and smaller lots at from 50c to 60c.

QUICKSILVER.—Jobbers only are in the market, and sales have been made on the basis of $48 per flask in lots of 100 flasks. London, £8 15s.

A Strike and Boycott that will Cost an Industry.

At the annual meeting of the directors of the Keystone Driller Co., Beaver Falls, Pa., held this week, the question of rebuilding the departments destroyed by fire about two months ago or removing the plant to another point owing to the enmity of the citizens of the place was considered and the following committee was appointed to consider the removal of the plant: Rev. James McElree, Robert McKnight, Rev. M. Wiley and Samuel Rowan. A site at Scottdale, Pa., is under consideration, and owing to the excellent transportation facilities offered it is probable that the plant will be removed to that place. Last May a strike was declared by the machinists employed numbering about 35, and when they were replaced by non-union men every effort was put forth by the union machinists of that place to drive the non-union men out of town and fights were numerous. The boycott was also resorted to, and when it was seen that the plant continued to operate despite their riotous acts they became even more bitter. The plant was destroyed by fire last November, and while it was never learned how the fire started indications pointed strongly to incendiarism. Throughout the strike the local authorities sympathized with the strikers, and the machinists employed were given no police protection whatever. Nor did the authorities show any great interest in apprehending those supposed to have caused the fire, although circumstances pointed strongly in certain directions. For this reason the stockholders who have their money invested do not believe that Beaver Falls is the proper location for their plant, and there is every indication that the town will lose an industry that employed fully 100 of its citizens and disbursed more than $2,000 in wages weekly.

The Illinois Bridge & Iron Co., Sullivan, Ill., contemplates moving from that city, but definite action will not be taken before May 1. The company is open to propositions from any town adapted to its business.

DECISION AGAINST STRIKING MOLDERS.

At Baltimore, last Saturday, Judge Morris in the United States court affirmed the restraining order already issued and extended the injunction against the striking iron molders of Isaac A. Sheppard & Co. He decided against the union at every point. He said that the court had to decide merely whether, as charged in the bill, the striking iron molders had made a systematic effort to prevent others taking their places. It had been established by the evidence, Judge Morris said, that the men had opened headquarters which they had frequented for some purpose, whether lawful or unlawful, and that there had been assaults and a stirring up of the mob spirit against those who had taken the place of the strikers. It was clear that the strikers by means lawful or unlawful, had sought to prevent the works being operated. There was no doubt, Judge Morris said, that the business of Isaac A. Sheppard & Co. was unlawfully obstructed, and the men who continued in their employ were likely to be visited at their boarding houses, assailed with opprobrious language and otherwise harrassed by acts sometimes accompanied by violence. Jurisdiction in the case was conferred upon the United States court, the judge held, by the diverse citizenship of the parties.

American Foundrymen's Association.

At a meeting of the Milwaukee Foundrymen's Association last week a resolution was adopted extending a formal invitation to the American Foundrymen's Association to hold its convention for 1903 in Milwaukee. At the last convention held in Boston in June, 1902, it was tacitly understood that the next meeting would be held in Milwaukee, but the final decision was left to the executive committee, and it will soon vote on the invitation which Milwaukee foundrymen have enthusiastically extended.

The Benskin Mfg. Co., of Canton, O., manufacturer of fillets, is just finishing its tenth year, and its record is one of steady increase, each year showing a larger business than the preceding one. In 1902, the expansion was 50 percent beyond the volume of 1901. A feature of the business is the repeated and increasing orders from early customers. The leather fillet manufactured by the company has curved sides, geometrically correct. In wood the company's obtuse angle fillet is a new construction.

The calendar of the Roessler & Hasslacher Chemical Co., ferro-alloys and metals, 100 William street, New York, is printed on Japanese wood veneer and the silky background is a pleasing feature. The Washington Coal & Coke Co., of Pittsburg, is also circulating a neat business reminder in calender form.

M. H. Treadwell & Co., of New York, are sending to the trade a 12-inch steel rule of guaranteed accuracy, which will not only serve as a reminder of the Tread-Kill shaking grate, but will be found very useful to the recipients. The company has recently completed installations of this grate in the steam plant of some large buildings. Among these in New York are the St. Regis Hotel, the Johnson Building, cor. 28th St. and Broadway, the Times Building on Park Row, the Battery Place Building near Battery Park, the Bank of the Metropolis and the Muschenheim Hotel, as well as the Continental Iron Works at Brooklyn.

The second monthly reunion of the members in New York of the American Society of Mechanical Engineers will be held at the Society house Feb. 3 at 8:15 P. M., when Ralph L. Morgan of Worcester, Mass., will present an illustrated paper on "The Heavy Steam-Driven Automobile Truck." Subsequent evenings like this one will fall at regular intervals on the first Tuesday of March, April and May.

The coke manufacturers in Virginia and nearby districts having orders beyond the capacity of their ovens, E. L. Harper, president of the Big Stone Gap Iron Co., Big Stone Gap, Va., went to the furnace from New York on Jan. 20 and prepared the first kiln of coal to coke on the ground. This was fired within four hours after his arrival. The company is now producing a large quantity of coke, of analysis as follows: Volatile matter, 2.17 per cent; fixed carbon, 91.93 per cent; ash, 5.90 per cent; sulphur, 0.85 per cent. If a sufficient number of furnaces took similar steps, the coke situation might be considerably relieved.

"Crane's List" for January, 1903, has just been issued by A. M. Crane & Co., Inc., Chicago and New York. It is devoted to the "everything in iron and steel" handled by this company and its text and make-up bear the marks of live editing. Emphasis is laid upon the 60 and 90 day deliveries of German structural steel made by the company. Among other departments noted are those of structural castings, Muskingum sheet steel, plates, roofing and siding and shafting.

The Ohio Iron & Steel Specialty Co., Cuyahoga Falls, O., has recently made important additions to its plant, which now has a 10-inch Belgian mill and an 18-inch roughing mill. Work on the construction of an open-hearth steel plant will be begun next summer.

The Susquehanna Iron & Steel Co., of Columbia, Pa., is about to install an electric power distribution plant in its mills. A recent purchase from the Westinghouse Electric & Mfg. Co. comprises a 400-kilowatt, alternating-current generator, one 200-h. p. induction motor, and 300 to 400-h. p. in motors, ranging in size from 50-h. p. to 20-h. p.

At the annual meeting of the stockholders of the Monongahela Connecting Railroad Co., held at Pittsburg, Pa., this week, directors were elected as follows: B. F. Jones, Jr., W. W. Willock, W. L. King, W. L. Jones, J. B. Laughlin, W. C. Moreland and Irwin B. Laughlin. Officers were elected as follows. B. F. Jones, Jr., president; W. W. Willock, vice president and general manager; W. C. Moreland, secretary and treasurer; John L. Moore, assistant secretary and assistant treasurer, auditor and purchasing agent; H. S. Kiehl, general agent; F. A. Ogden, general freight agent. The executive committee consists of B. F. Jones, Jr., W. W. Willock, W. L. King, W. L. Jones and J. B. Laughlin.

Machinery from the New Castle plant of the American Steel & Wire Co. is being removed to Monessen, Pa., where it will be installed in the plant of the Union Steel Co.

Under the new specifications for nickel steel rails that have been prepared by the engineers of the Pennsylvania Railroad the amount of nickel alloy will be increased from about 3 to 5 percent. This increase it is claimed by the engineers will greatly increase the wearing qualities of the rails. An order for 5,000 tons of nickel steel rails to be delivered this year was placed with the Carnegie Steel Co. by the Pennsylvania Railroad some time ago, being the largest order for such rails ever placed. They will be used on the sharp curves of the system in Pennsylvania where the ordinary steel rail has a very short life.

The promoters of the Standard Metal Tile & Ceiling Co., the combination of metal ceiling manufacturers recently projected, were in Pittsburg this week arranging for the absorption of the plants of the S. Keighley Metal Ceiling Co. and the Iron City Metal Ceiling Co. of that city. The new company has been incorporated with $5,000,000 capital. Other plants that may be included in the consolidation are as follows: The Penn Metal Ceiling Co., Philadelphia; Berger Mfg. Co., J. H. Eller & Co. and the Canton Steel Roofing Co., Canton, O.; Friedley & Voshardt and the Kinnear & Gager Co., Columbus, O.; Caldwell & Peterson, Wheeling, W. Va., and the New York Metal Ceiling Co. and Northrup & Co., New York.

The blast furnace of the River Furnace & Dock Co., Cleveland, which had been out of blast about 90 days on account of an accident, was blown in this week. The furnace has been almost entirely rebuilt and is now up to date in every particular.

THE IRON TRADE REVIEW

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PIG IRON FOR FOUNDRY AND STEEL WORKS.

The pig iron statistics of the American Iron and Steel Association for 1902, as printed in another column, show a production beyond any of the preliminary estimates—17,821,307 gross tons, or 1,942,953 tons more than in 1901 and over 4,000,000 tons more than in 1900. Such a record in the face of the unparalleled difficulties with which the furnace interests of the country contended last year is marvelous. When to the production are added the imports of pig iron last year, which were about 575,000 tons, our consumption of pig iron for the year appears to be about 18,400,000 tons, our exports being less than 30,000 tons.

The increase in production of steel-making pig iron last year was marked, as was also the case in the preceding year. A remarkable gain appears in basic iron, of which 40 percent more was produced than in 1901. That there will be a further strong increase in basic pig iron is quite certain, in view of the large additions to the open-hearth capacity of the country. In the scarcity of scrap, pig iron must be had in greater percentage than heretofore, for the manufacture of open-hearth steel. Bessemer iron, while it showed a gain of 8.3 percent over 1901 did not make up so large a percentage of the whole as in 1901, being 58 percent as against 60.4 percent in 1901, 57.6 percent in 1900, 60 percent in 1899 and 62.3 percent in 1898. The following table shows in gross tons the total of the various classes of iron produced last year and in the three preceding years:

	1899	1900	1901	1902	1902 comp. with 1901
Bessemer	8,202,778	7,943,452	9,596,793	10,393,168	inc. 8.3%
Basic	985,033	1,072,376	1,448,850	2,038,590	inc. .40%
Fdy. and forge.	4,432,892	4,773,414	4,832,711	5,389,549	inc. 11.5%

It will be seen that the production of basic pig iron has more than doubled in three years. Another noteworthy feature of the table is that the production of foundry and forge iron increased 550,000 tons over 1901 while in the latter year the total of foundry and forge iron increased only 60,000 tons over 1900. There must be added, also, the large importations of iron last year, nearly all of which was for foundry use. There is no separation as yet of the production of forge iron from that of foundry iron for 1902, but it is safe to attribute the increase almost entirely to the foundry industry. The higher price of bar iron turned considerable bar trade to steel the past year, and it is to be considered also that of the forge iron produced a portion was taken by pipe foundries.

The acuteness of the fuel embargo in Pennsylvania, Ohio and Illinois as compared with the South is reflected in the figures. While Pennsylvania made a 10 percent increase over the production of 1901, Ohio a 9 percent increase, and Illinois an 8 percent increase, the Southern States showed a gain of 20 percent.

Surprising as is the pig iron record for 1902, and with all its increase over 1901, the indications are that even a greater total will be shown for 1903.

PITTSBURG'S TRANSPORTATION PROBLEMS.

That the Pittsburg district, the busiest and most prosperous section in the iron trade of the world; that Pittsburg, whose tonnage exceeds that of the port of New York; that Pittsburg, which the friends of a certain railroad have even ventured to claim has been made by that railroad, should be shown to stand in need of vastly greater shipping facilities than are now at hand, is a spectacle which should attract the notice of all thinking men. That the wonderful advance of that district has not been the forced growth due to fortuitous shipping conveniences is more than proved by the fact that for months blast furnaces and mills have been idle for lack of fuel and that at frequent intervals thousands and thousands of tons of raw and semi-finished material, which should find their way into immediate use, have had to be stocked, involving incalculable loss and expense. That the Pittsburg district has not been the only sufferer, but that the Valleys, Cleveland and Chicago have suffered from delays to shipments which should pass through Pittsburg, only accentuates the fact that railroads which are now and have been patently opposing increased shipping facilities have notoriously failed to provide means to handle a tonnage which they tacitly claim is mortgaged to them.

There are at the present time barely 20 main-line tracks leading out of Pittsburg:

Pennsylvania Railroad System:	
Pennsylvania Railroad Division:	
Main Line	4
Western Pennsylvania Division	1
Monongahela Division	1
Buffalo & Allegheny Valley Division	1
Pennsylvania Lines West:	
Pennsylvania Company (Ft. W., E. & P., P., Y. & A., C. & P.)	4
P., C., C. & St. L.	2
Pennsylvania, B. & O. System:	
Main Line	2
Wheeling Division	1
P. & W. Division	1
Pittsburg & Lake Erie, Main Line	2
P., McK. & Y. Division	1
	20

We say there are barely 20 main-line tracks leading out of Pittsburg because the main line of the Baltimore & Ohio is not absolutely double track, although it is for some distance out of Pittsburg, while the Pennsylvania Co. is four-track only from a point just west of the city limits of Allegheny. From there to the Union Station, Pittsburg, there are but two tracks in service, with one track over the Ohio Connecting Railroad to the Pan Handle. The Bessemer & Lake Erie does not enter Pittsburg over its own track, nor does the Buffalo, Rochester & Pittsburg.

Ten years ago there were within one or two as many tracks as now, with the tonnage probably only a third of what is now offered. We must go back to a time when the

tonnage was less than a tithe of the present before we find the number of tracks reduced by anything like one-half. Are the improvements in the utilization of tracks by heavier train loads and better control sufficient to take care of the additional tonnage? We think not. Faster running, *per se*, will not do it. Theoretically, if the speed of a train is doubled, the distance in which it can be stopped is quadrupled, and putting trains four times as far apart, while only doubling their speed, cuts down the number of trains passing a given point in a given time by one-half.

The topographical position of Pittsburg is such that most of the lines out pass between a river on the one side and a hill on the other. This has had two effects: it has discouraged railroads from adding additional tracks, on account of the expense, and it has encouraged them to rest secure with their insufficient facilities because nature made it difficult for new roads to force an entrance. The engineers of the Wabash railroad have seen their way to overcome nature's obstacles, but for nearly a year have been confronted with obstacles placed by other railroad interests and by the city government of Pittsburg itself. We must refrain from discussing this latter phase.

As to improvements in Pittsburg's rail shipping facilities there is comparatively a small modicum of hope. The Pennsylvania Co. is elevating its tracks from the Union Station to the city limits of Allegheny, which will give four tracks in place of two; it is building an eastern approach to the Ohio Connecting bridge, and decreasing the grade of the western approach, which may be double tracked, along with the rest of the connecting line. Additional portions of the Western Pennsylvania Division are to be double tracked. The Pittsburg, McKeesport & Youghiogheny Division of the Lake Erie is to be double tracked to McKeesport. A detached portion of the four track line of the Pennsylvania Co. below Pittsburg is to have additional tracks. The Wabash will ultimately gain an entrance into Pittsburg.

The Bessemer & Lake Erie road does not enter Pittsburg, but it has performed most signal service in relieving what would have otherwise been a much more intolerable condition. It is single track except for 24 miles of long sidings, to which are to be added the present season about 12 miles. The additional track is year by year being added to in the full ratio which the increasing tonnage requires, but the road is practically a private enterprise.

When the Engineers' Society of Western Pennsylvania, with nearly 700 members, mostly Pittsburgers, discussed last week the subject, pregnant with possibilities of suggestion, "Pittsburg's Transportation Problems, Present and Future," the net result was a history of the railroad development, arraignments of the river interests on the one side and of the railroad interests on the other, and an analysis of the details with which railroads manage their shipments.

The relief which Pittsburg will get from railroad improvements in progress or projected will be too small and too tardy to right matters. Recourse must be had to water, which made Pittsburg in the first place. While Andrew Carnegie's boast of three mills per ton mile for rail shipments of ore and coal has been realized in practice, with Pittsburg's insufficient and uncertain river shipping facilities freight can be and is carried at a cost of three-tenths of a mill per ton mile. Surely a reduction of 90 percent in the cost of moving freight is entitled to the fullest exploitation and encouragement. Yet with all the agitation of a year for river improvement the net result so far has been nothing but the order of the Secretary of War, from which it seems there is happily no appeal, that one bridge at Pittsburg must be raised. This bridge, almost condemned as unsafe years ago, stands right at the mouth of the Allegheny River, has prevented all but the smallest craft from entering the river, and has been a most dangerous menace to the few for which it gave sufficient clearance. Not only has it shut off nearly all traffic on the Allegheny River, but it has curtailed the storage facilities of the Pittsburg harbor, formed by the dam below the junction of the Allegheny and Monongahela, so that in times of drought the storage capacity for coal mined on the Monongahela has been insufficient. Mines have had to be shut down, when the Monongahela portion of the harbor was filled, whose product could otherwise have been held in the Allegheny awaiting a rise.

The corralling of practically every manufacturing site on the lower Monongahela at enormous prices, the almost infinitesimal cost of river transportation, the building of an isthmian canal, the steel corporation's purchase of land at New Orleans for immense docks and warehouses, the establishment of the wire product distributing warehouse at St. Louis, the development of the South and the Ohio valley, all point unmistakably to the absolute necessity of slackwatering the Ohio from Pittsburg to Cairo and the Allegheny for some distance above Pittsburg, and removing all overhead impediments to river traffic. How soon the work will be accomplished is the only question.

The benefits of the improvement will not be merely local. Districts for whose raw material Pittsburg is merely the gateway, the valleys, Cleveland, Chicago, the west and the south, will feel the benefit. With the isthmian canal the Pacific coast will be no small gainer.

LABOR UNIONS AND STRIKE VIOLENCE.

It has been the customary thing for labor union leaders to disclaim responsibility for violence growing out of strikes. President Mitchell has been plausible in his disavowals in connection with the reign of murder and terror under which citizens in the anthracite region lived in the months of the strike. Yet Judge Gray was impelled by the character of much of the testimony concerning violence by unionists to turn to Mr. Mitchell and bid him with some vehemence to bring his organization up out of the mire in which the deeds of many of its members had sunk it. Interrogation failed to elicit evidence that any steps had been taken by the union to discipline any of its members who had been guilty of rioting and assault.

At Chicago the past week the trial has ended, of Jacob E. Johnson, business agent of a local union of brass molders, and five other committeemen of the union, charged with conspiracy to injure non-union men in the labor troubles of last year. Johnson and one other were found guilty and fined $1,250 each. Of the remaining four, two were acquitted and two were found guilty and fined $750 each. It was testified that Johnson had instigated violence against non-union workers. When the strike showed signs of waning, the testimony was that Johnson proposed as the only thing left to do that a "wrecking crew" be organized and "drop a few logs on the heads of those fellows," referring to non-union men employed in the basement of one of the struck shops. It was shown that four of the defendants arranged for the employment

of a band of men to fall upon and attack non-union men who were pointed out by pickets. As a result of these tactics two men were shot and several severely beaten.

Violence is an almost inevitable attendant of strikes. Fear of personal injury, social boycott, loss of property, and indignity to wives and children, is the chief reliance in the war upon the men who may elect to work in a picketed plant. Labor leaders—the best of them—publicly condemn violence; but there is no escape from the charge that the machinery of the modern strike as conducted by the majority of unions, is not complete without intimidation, property loss, assault and not infrequently murder. When the public utterances of their leaders, who are intelligent above the average of their membership, are so bitter against courts and the militia, the unions cannot expect to escape all responsibility for the lawlessness of their more ignorant members, particularly after their minds have been incited against their employers and against non-union men by the oratory that generally precedes a strike. Disavowals will be better received when the unions show a disposition to put their law-breaking members under the ban.

Personal.

During the absence in Europe of President Jas. Ross, the management of the Dominion Iron & Steel Co. and the Dominion Coal Co., will be in the hands of the vice presidents of the companies, Hon. Geo. A. Cox and Hon. R. Forget. C. Shields, second vice president and general manager, will be in charge of the mines.

Joseph E. Schwab, of New York, president of the American Steel Foundries, spent several days last week inspecting the plant at Alliance, O., and those in the Pittsburg district.

William Fitzpatrick, traveling representative of the S. Obermeyer Co. in the Eastern States, was severely injured at Pittsburg last week, being struck by a street car. One arm was broken and he was otherwise severely injured.

John Birkinbine, of Philadelphia, has been re-elected as president of the Franklin Institute.

E. F. Bradt has resigned as manager of the mines of the Lake Superior Consolidated Co. and will become manager of a mining company about to be organized, with D. M. Philbin, of the Eastern Minnesota Road as president. The new company will open a large mine on the Mesabi range about six miles from Hibbing and directly east of the Sellers. Many millions of tons of ore have been proved up.

A dinner was given to the officers, managers, superintendents and sales managers of the Carnegie Co. at the Duquesne Club, at Pittsburg, Saturday evening, Jan. 24. James Gayley was the guest of honor. Hon. James H. Reed, general counsel for the Carnegie interests and director in the steel corporation, presided. Mr. Gayley responded to the toast "The United States Steel Corporation." H. P. Bope, first vice president of the Carnegie Steel Co., spoke on "The Carnegie Co."; A. B. Wolvin, on "Our Inland Marine," and Thomas Lynch, president of the H. C. Frick Coke Co., on "Transportation." Those present were: Charles W. Baker, George Baker, W. R. Balsinger, L. C. Bihler, W. W. Blackburn, J. H. Blackburn, C. D. Fraser, James Gayley, G. H. Hamfeldt, E. J. Hamilton, J. Ogden Hoffman, F. E. House, H. P. Bope, L. T. Brown, J. J. Campbell, N. D. Carpenter, H. P. Howell, Nelson P. Hulst, A. R. Hunt, Charles Cassils, D. M. Clemson, D. H. Coble, W. R. Conrad, Thomas F. Cole, W. E. Corey, I. W. Jenks, Norwood Johnson, George W. Johnson, Walter M. Kelly, O. W. Kennedy, G. W. Kepler, W. B. Dickson, Charles E. Dinkey, A. C. Dinkey, H. A. Finnerty, R. A. Franks, D. G. Kerr, J. P. Kessler, Jr., Wilbur Sargent Locke, Homer J. Lindsay, Thomas Lynch, W. C. Magee, E. H. Martin, J. S. Matson, Thomas Morrison, W. C. McCausland, Thomas McDonald, George A. McDonald, F. R. McFeatters, C. E. McKillips, John McLeod, James R. Mills, Jr., John C. Neal, Frank C. Neal, W. J. Olcott, Gibson D. Packer, William J. Post, N. M. Peterson, James H. Reed, John Reis, Robert Richardson, W. J. Root, James Scott, John R. Scott, McGilvary Shiras, William H. Singer, T. Guilford Smith, C. A. Stone, Charles L. Taylor, W. J. Totten, W. H. D. Totten, Jr., B. H. Taylor, E. H. Utley, William Whigham, H. D. Williams, A. B. Wolvin, John E. Woods, Thomas Woods

Lake Superior Iron Mines.

It is reported that J. J. Hill has closed the option taken some time ago for a three-fifths interest in the Laura and Winifred mines at Hibbing, the purchase price being $160,000. Capt. M. L. Way, of Virginia, Minn., and associates hold a two-fifths interest.

Corrigan, McKinney & Co., Cleveland, are working farther west on the Mesabi range and have taken a lease of three forties owned by Longyear and Bennett, about three miles west of the Stevenson mine.

The Volunteer mine on the Cascade Range, Lake Superior recently transferred to the steel corporation in its purchase of the Union Steel Co., will be worked for a large output the coming year. The steel corporation now owns nearly all the properties on that range, all but the Wheat (Corrigan, McKinney & Co.) and the Richmond (A. Maitland) and the fee to this latter is owned by it.

The little town of Claysville, Pa., located a short distance from Washington, Pa., is being boomed as a location for industrial plants. Already the Claysville Foundry & Machine Co. has a plant in operation and the South Pittsburg Steel Co. will locate a structural fitting plant in the town. The erection of a brass foundry is also being promoted.

J. S. McKesson, property agent for Corrigan, McKinney & Co., of Cleveland, operating the Charlotte furnace at Scottdale, Pa., closed negotiations this week for the purchase of 5,000 acres of coking coal land in the Blacklick District, Indiana County, Pa. Work on the erection of 300 bee-hive ovens will be commenced immediately and pushed to completion at an early date. The coke produced will be used in the Charlotte and other furnaces operated by this concern.

The Jones & Laughlin Steel Co., Pittsburg, Pa., has plans prepared for the erection of a railroad bridge over the Monongahela River at Hazelwood, Pittsburg, which will form the connecting link between its new railroad and the Monongahela River Connecting Railroad, which is now operated as a mill road along both sides of the Monongahela River, serving the Soho, Eliza and South Side plants. A bill has been introduced in Congress by Congressman Dalzell authorizing the erection of this bridge. The 8,000 tons of steel required will be supplied by the structural mills of the company.

The Beaver Valley Metal Co., New Brighton, Pa., is installing two additional brass furnaces which will greatly increase the output of the plant. The company was recently organized and took over the foundry operated by Louis A. Glaser. A specialty is made of copper, bronze, brass and aluminum castings, while a non-shrinkable metal for patterns is also produced. W. D. Berry, who has been in charge of the brass foundries of the Carnegie Steel Co. and of large plants in the East, is president; E. T. McComb, vice president, and L. A. Glaser, secretary and treasurer.

The Falls Machine Co., Sheboygan Falls, Wis., has taken possession of the plant formerly operated by the Phœnix Iron Works and is changing the line of products from agricultural implements to wood working machinery. F. Diehl, vice president of the company, has a number of patents on labor saving devices and it is the intention to manufacture all of his patented machinery and to enlarge on the line as quickly as possible. It is also the intention to do general foundry and machine work. Additional machinery is now being installed in the plant, which will be up to date in every particular.

The Drawback on Wire Products.

In the hearing of Jan. 15 before the Ways and Means Committee of the House of Representatives at Washington, on the Lovering bill providing for the amendment of the drawback law, the relation of the wire trade to the proposed change was explained by W. H. Seaver, secretary of the National Wire Corporation of New Haven, Conn. In explanation of the purpose of his bill Mr. Lovering said that it was simply administrative; that it did not touch the schedules, nor open up the question of tariff revision, but makes operative what it is believed the framers of the Dingley bill intended. He expressed the belief that the bill was safeguarded in every way so as to protect the government against loss. The bill provides for the return of 100 percent, instead of 99 percent, of the duty, where material is re-exported; also that when imported duty-paid materials are used in the manufacture or production of articles in the United States, but they cannot be specifically identified by the manufacturer or producer as having been used in the manufacture or production of any article, as is now required, a drawback may be allowed on the exportation of such articles.

The statement of Mr. Seaver presenting reasons in favor of the passage of the bill was as follows:

"I represent more than the National Wire Corporation, inasmuch as there has been recently formed the National Steel & Wire Company, who also operate plants in DeKalb, Ill., and in Oakland, Cal. The Oakland plant will be running in the next few weeks. The DeKalb plant is running and has been for some years. We have built our plants with the distinct idea of engaging to a very large extent in the business of wire rope, field fence and wire specialties, including nails. At the present time we are doing some export business; in fact, we have sent several shipments to Canada, and under the present drawback regulations we have no difficulty in identifying the material that goes into that business. But when we get into the more highly finished lines of product, the difficulties are very much greater. For instance, in making wire fence, it is possible for us to identify each size and each particular lot of wire that goes through the wire mill to the galvanizing house and into the fence mill; but it is very difficult and requires a great deal of extra expense in bookkeeping, clerks, etc. It would be of great benefit to us, and would aid us largely in pushing our foreign business if this matter were simplified. We can under the present law, identify all material, but it is very difficult.

"Another point is this: We make in our New Haven mill the raw material for the other mills. We use imported billets and domestic billets, depending on the market. The quantities will vary, but nearly always we are using both. Now, I believe it is a very simple matter for us to identify the value of imported and exported material to the satisfaction of the Treasury officials. In other words, it is practically all of the lower grades of Bessemer or open-hearth steel, which are used in the steel business generally, and if we had the privilege of using American or imported raw material, without regard to the necessity of identification, it would simplify all of these matters, and would enable us to push this export business to a very much greater extent than at present. We are now making connections in foreign countries for the sale of fencing, in particular, and will soon add wire rope as well, so we cannot express too strongly the interest that we have in this particular measure on that account.

"In regard to section 2: That is another point that touches us very closely. In the very near future we expect to be very large manufacturers of wire rope, and one of the largest consumers of wire rope is the ship building industry. Of course, under the present law they can import wire rope and get the drawback of duty; whereas, unless we make our wire rope entirely of imported wire, when of course we do not want to do, in view of the fact that we can make the raw materials ourselves, from imported steel billets, we are not able to secure the drawback that a foreign manufacturer of wire rope would secure.

"The retaining of 1 percent of duty may be a small matter; on the other hand, in view of the volume of business we do, it amounts to a great deal in the course of a year, and in so far is an additional tax upon us. Our sole object is to develop our business to the very largest extent possible. Our domestic business at the present time keeps our plants fully occupied, but we are increasing the capacity of our plants very largely, and we are looking to the time in the near future when it will be necessary for us to find foreign markets, and in that way take care of the increase of production of our various mills. In so doing, we will employ more men, put more money into labor, and because our labor is employed in the higher finished lines, the percentage of labor cost is very much greater, than in the case of the United States Steel Corporation, which produces in the great majority of cases the less highly finished products."

The Chairman: The drawback allowance for the last three years, as I understand, was about $5,000,000 and of course this 1 percent would be about $50,000?

Mr. Seaver: And it is to that extent an additional tax.

The Chairman: What you desire is a drawback on domestic material where you have imported an equal amount of foreign material of the same class, etc?

Mr. Seaver: Yes, sir.

The Chairman: At present we charge countervailing duties on exports from foreign countries, and suppose the foreign Governments should regard this as a bounty paid on domestic iron, for instance, used in manufacture and exported, and should put on a countervailing duty equal to that?

Mr. Seaver: I can not understand how they could do that. I speak now for our own particular interests. I can not see how it would change the condition as it already exists; it simply means the same thing, only under different regulations, as I look at it.

The Chairman: As you have, perhaps, noticed in the papers, Germany is already making some trouble about the present drawback law, stating that we not only pay the full amount of duty collected but pay more than that, which operates as an export bounty and they make complaints against it. It has occurred to me that if we allowed this drawback on materials used that were domestic materials, domestic productions, they would have the same right to say that it was an export bounty as we have said in the case of sugar?

Mr. Seaver: My answer to that is that the duty must be paid as the law provides on the imported materials, and it should be clearly evident, I think, that no export bounty would be effective to any manufacturing concern where they are obliged already to pay the full amount or more than the full amount of the drawback, in duties to the government. In that connection, I might say that I have recently made a price for a large export order to South Africa. I made it through a large New York export house and I did not know what the result would be; but I was notified a few days ago that my price was the lowest offer. That price was based on having the steel made by the Dominion Iron & Steel Co., imported into our New Haven mill, put through the process of manufacture there and exported from New York. I do not know that we will get the order.

The Chairman: And then you get the drawback?

Mr. Seaver: We can get the drawback, because we can identify that material; but when we get into the higher grades, the finer grades, it is very difficult. The difficulty many times would discourage the export business.

Mr. Swanson: Is the company a constituent company of the United States Steel Corporation?

Mr. Seaver: No, sir.

Mr. Swanson: What is the difference in price for steel billets and raw material in foreign countries and at home, at the present time?

Mr. Seaver: Nearly $10 a ton.

Mr. Swanson: Then you can buy the steel cheaper abroad than at home?

Mr. Seaver: At the present time we can buy it abroad and pay the duty cheaper than we can buy it at home. These conditions are somewhat abnormal.

Mr. Swanson: Without the drawback, your company would be to a large extent dependent upon the United States Steel Corporation?

Mr. Seaver: Yes, sir; it would at present absolutely shut us out of the foreign market as independent producers. They

of course have a greater profit on cruder products than we have, because we buy much of the raw material that goes into the more highly finished lines of product.

Mr. Swanson: If you do not buy from foreign countries, whom are you compelled to buy from in this country?

Mr. Seaver: The United States Steel Corporation, the Jones & Laughlins Co., the Cambria Steel Co., the Pennsylvania Steel Co., the Lackawanna Steel Co., soon to be in operation, and many others.

Mr. Swanson: What quantity of raw material that would be purchased is controlled or produced by the United States Steel Corporation?

Mr. Seaver: I am not familiar with the latest figures, but it is safe to say that it is more than two-thirds of the material.

Mr. Metcalf: Are you engaged in the export business at the present time?

Mr. Seaver: In Canada.

Mr. Grosvenor: Is there any one corporation or combination that controls the price of the raw material in this country?

Mr. Seaver: I should say yes; that the United States Steel Corporation controls the price, if you consider that the purchase of the surplus product of independent furnaces constitutes control.

Mr. Grosvenor: What has been their action towards raising or lowering the price?

Mr. Seaver: Their policy has been to retain the prices at such a high level that many independent mills have found it very difficult to live. It has therefore been necessary for them to go into the more highly finished lines, which the United States Steel Corporation and its constituent companies do not touch, except to a limited extent. Many small wire manufacturers today are wholly dependent upon independent mills for their supply of wire rods and we are selling raw material to many of them in the Eastern part of the country, who would find it difficult, if not impossible, to obtain a sufficient supply at a reasonable price were it not for our own company and others in the same line.

Mr. Grosvenor: Is it not true that there is a greater number of plants in the steel and iron business that have been built within the last year and that are now building than in any other equal length of time?

Mr. Seaver: I think so.

Mr. Swanson: What is your idea as to the present duties on iron and steel and the reduction of them, and free trade as to those products?

Mr. Seaver: For the benefit of the country as a whole I should say keep them as they are. For our own personal benefit, I should naturally say reduce them; but I think we are broad enough to look at the matter from the standpoint of the whole country. Our whole policy is and will be to develop the higher grades of material, where a few dollars a ton on raw material is not an important factor.

Mr. Swanson: How does the average cost of production of iron and steel in this country compare with the average cost of production of iron and steel in other countries?

Mr. Seaver: Theoretically it is about the same. Of course it is known we have the greatest opportunities in the world in the supply of raw materials, but when it comes to a question of labor, that is a different matter. There is no doubt that the labor costs us very much more.

Mr. Swanson: If you can export your raw material abroad and compete with the other nations in the production of iron and steel even in the finished products and pay the freight going there, you certainly ought to be able to compete in the home markets?

Mr. Seaver: I think so.

Mr. Grosvenor: What is your product when finished?

Mr. Seaver: We manufacture wire rods, wire of all kinds, wire fencing, wire rope, wire nails to a limited extent, and certain other wire specialties.

Mr. Grosvenor: What is the condition of steel manufacturers in the United States, taking the whole line? Is there a greater demand than there is product, or is there a greater product than there is demand?

Mr. Seaver: There is a differential in there that is rather hard to explain. I know it to be a fact that in spite of the enormous demand in this country, certain companies are still holding on to their export business at prices which I know are very much less than those obtained in this country. If what you suggest is true, that the domestic demand is greater than the production, it would seem that they would try to fill that domestic demand more exclusively than they do now, except so far as necessary to retain a foothold in foreign markets.

Mr. Swanson: Does the United States Steel Company charge you more for the raw material when you buy from them than they do foreigners?

Mr. Seaver: When they sell it in the same form, yes, sir.

Mr. Swanson: The export price to foreigners is less than it is to you?

Mr. Seaver: I know that they have offered wire rods in Canada at a price which is several dollars a ton less than they offer the same rods for domestic use.

Mr. Swanson: When you sell your finished product, do you sell it abroad at less than you sell it at home?

Mr. Seaver: Yes, sir; because we get the benefit of the drawback.

Mr. Swanson: The only difference is the difference of the drawback?

Mr. Seaver: Yes, sir; in fact, if it was not for that benefit it would be absolutely impossible under present conditions to sell any material abroad.

Mr. Swanson: I understand that your business is in finished material, and that the wages you pay in your mills are higher on the average than in the other lines of the steel business?

Mr. Seaver: Yes, sir.

Mr. Swanson: If we gave you free raw material you could continue to pay your present wages and continue to compete with the producers in other countries?

Mr. Seaver: Yes, sir. The instance I gave as to my prices for South Africa being lower than any price offered in the world I think answers that question pretty fully.

Mr. Swanson: Have you made any comparison as to the wages paid abroad in the same class of work that you are doing?

Mr. Seaver: It is impossible to find out unless we should spend considerable money and time in investigating.

The Chairman: Do you base your statement on the South African case?

Mr. Seaver: No, sir. That is simply an instance of business which I referred to.

Mr. Tawney: It is to be presumed that the cost of material abroad is greater than the cost to you, or otherwise you would not have been able to make that price?

Mr. Seaver: Presumably so.

Mr. Swanson: You have machinery and machinery is an element in the production of the material that lessens the cost, and the ingenuity of American labor and the improved machinery enables you to produce the finished product cheaper than abroad and still pay the higher wages?

Mr. Seaver: That is it exactly. We simply ask that this present regulation for the collection of drawbacks be simplified as much as possible in order that we may continue along the lines we have already inaugurated and do it much better than under the present regulation.

The Keystone Boiler & Radiator Co., Huntingdon, Pa., was organized a year and a half ago and now employs 125 men. The company is patentee and manufacturer of the Keystone hot water and steam boiler. It also makes three different styles of radiators running in all standard sizes from 45 inches down. The company has been unable to fill all its orders and therefore has been compelled to enlarge its plant. It is now equipped with improved machinery, using steam and electric power as well as compressed air. Already contracts have been taken for upwards of 1,000,000 feet of radiation as well as several hundred boilers to be shipped during the year of 1903. The company has a capacity for melting 80 tons of iron per day and the floor space of the foundry and machine shops covers over 100,000 square feet, with over 10 acres of ground. The plant is on the main line of the Pennsylvania Railroad.

17,821,307 Tons of Pig Iron in 1902.

The American Iron and Steel Association has received from the manufacturers complete statistics of the production of all kinds of pig iron in the United States in 1902; also of the stocks of pig iron which were for sale on Dec. 31, 1902. The total production of pig iron in 1902 was 17,821,307 gross tons, against 15,878,354 tons in 1901, 13,789,242 tons in 1900, 13,620,703 tons in 1899, and 11,773,934 tons in 1898. The following table gives the half-yearly production of pig iron in the last five years, in gross tons:

Periods.	1898.	1899.	1900.	1901.	1902.
First half	5,969,703	6,289,167	7,642,569	7,674,613	8,803,574
Second half	5,994,231	7,331,536	6,146,673	8,203,741	9,013,733
Total	11,773,934	13,620,703	13,789,242	15,878,354	17,821,307

The increase in production in the second half of 1902 over the first half of 1902 was 204,159 tons. The total increase in 1902 over 1901 was 1,942,953 tons. This is a somewhat smaller increase than the year 1901 showed over the year 1900, which was 2,089,112 tons. Nevertheless, says General Manager Swank, it is certainly remarkable that there should have been such a large increase in production in 1902, when there were serious adverse conditions to contend with, chiefly inadequate transportation facilities, resulting in a short supply of coke and iron ore and the banking for longer or shorter periods of many furnaces. The anthracite coal strike also seriously interfered with the activity of many Eastern furnaces. In 1901 this country made more pig iron than Great Britain and Germany combined, and in 1902 we made more than these countries and Belgium combined. The whole number of furnaces in blast on Dec. 31, 1902, was 307, against 266 on Dec. 31, 1901, and 232 on Dec. 31, 1900. The production by States was as follows:

TOTAL PRODUCTION OF PIG IRON.

States.	Blast Furnaces. In Blast June 30, 1902.	Dec. 31, 1902. In.	Out.	Total	Production. Gross tons of 2,240 lbs. (Includes Spiegeleisen.) First Half of 1902.	Second Half of 1902.	Total for 1902.
Massachusetts	.....	1	2	3	1,716	1,644	3,360
Connecticut	2	2	2	4	5,278	6,808	12,086
New York	9	10	10	20	186,523	214,846	401,369
New Jersey	6	6	5	11	105,293	86,085	191,380
Pennsylvania	109	116	33	149	4,045,965	4,071,835	8,117,800
Maryland	4	4	2	6	148,619	154,610	303,229
Virginia	16	19	7	26	263,233	273,983	537,216
North Carolina	.....	.....	2	2	12,401	19,914	32,315
Georgia	2	3	2	5			
Alabama	31	39	7	46	700,546	771,665	1,472,211
Texas	.....	1	3	4	1,528	1,567	3,095
West Virginia	3	3	.....	3	93,297	89,708	183,005
Kentucky	6	5	3	8	51,089	59,636	110,725
Tennessee	15	16	6	22	187,359	205,419	392,778
Ohio	46	47	11	58	1,775,496	1,855,892	3,631,388
Illinois	19	15	5	20	879,800	850,420	1,730,220
Michigan	6	7	3	10	85,661	69,552	155,213
Wisconsin	6	6	0	6	131,531	142,456	273,987
Minnesota	.....	1	.....	1			
Missouri	2	2	.....	2			
Colorado	3	3	1	4	133,237	136,693	269,930
Oregon	.....	.....	1	1			
Washington	1	1	.....	1			
Total	286	307	103	412	8,808,574	9,012,733	17,821,307

Production according to fuel in 1902 is shown in the table below. It gives also the unsold stocks in the hands of makers, according to fuel, at the end of the four half years terminating June 30, 1901, and Dec. 31, 1901, June 30, 1902, and Dec. 31, 1902. The production of charcoal pig iron in 1902 was 378,504 tons, against 360,147 tons in 1901 and 339,874 tons in 1900. The production of mixed charcoal and coke pig iron in 1902 was 11,665 tons, against 23,294 tons in 1901 and 44,608 tons in 1900:

UNSOLD STOCKS AND PRODUCTION ACCORDING TO FUEL.

Fuel.	Stocks Unsold. Gross tons of 2,240 lbs. June 30, 1901.	Dec. 31, 1901.	June 30, 1902.	Dec. 31, 1902	Production Gross tons of 2,240 lbs. (Includes Spiegeleisen). First half of 1902.	Second half of 1902.	Total for 1902.
Bitumin'us	197,396	42,426	21,621	38,645	7,882,732	8,433,159	16,315,891
Anthracite	113,117	12,007	4,715	4,080	733,740	381,507	1,115,247
Charcoal	58,083	15,980	3,525	7,226	186,098	192,406	378,504
Charcoal and coke	3,964	264	.....	.....	6,004	5,661	11,665
Total	372,560	70,647	29,861	49,951	8,808,574	9,012,733	17,821,307

The mixed charcoal and coke iron referred to above was produced by one Tennessee furnace. The statistics of stocks of unsold pig iron do not include pig iron made by the owners of rolling mills or steel works for their own use, but only pig iron made for sale and which was unsold on the dates given. The stocks of pig iron which were unsold in the hands of manufacturers or which were under their control at the close of 1902, and were not intended for their own consumption, amounted to 49,951 tons, against 70,647 tons at the close of 1901, and 442,370 tons at the close of 1900.

The American Pig Iron Storage Warrant Co. held no pig iron whatever in any of its yards on Dec. 31, 1902. This is the first time since its organization in 1889 that the company has not held at least a small quantity of pig iron in its yards at the close of a calendar year. At the end of 1901 it had 3,000 tons. The distribution of unsold stocks at the end of the last four half-year periods is shown in the following:

TOTAL STOCKS OF UNSOLD PIG IRON.

States.	Gross Tons of 2,240 Lbs. June 30, 1901.	Dec. 31, 1901.	June 30, 1902.	Dec. 31, 1902.
Massachusetts and Conn	1,477	684	463	229
New York	14,930	4,907	772	2,661
New Jersey	3,150	648	241	700
Pennsylvania	138,921	20,750	9,279	5,122
Maryland	21,134	8,477	5,267	6,791
Virginia				
North Carolina, Ga., and Texas	4,388	1,066	.....	.....
Alabama	95,815	4,393	5,947	22,494
Kentucky and West Va.	8,067	3,156	1,589	1,125
Tennessee	11,595	1,361	1,559	3,554
Ohio	37,877	18,299	1,303	4,457
Michigan and Minnesota	35,206	6,906	3,441	2,908
Illinois and Wisconsin				
Missouri and Colorado				
Pacific States				
Total	372,560	70,647	29,861	49,951

STOCKS OF PIG IRON IN PENNSYLVANIA AND OHIO.

Pennsylvania.	Lehigh Valley	77,677	3,783	2,094	130
	Schuylkill Valley	17,136	4,736	1,076	400
	Upper Susquehanna Valley	5,090	1,409	1,182	2,256
	Lower Susquehanna Valley				
	Juniata Valley	7,978	600	3,110	1,598
	Allegheny County	1,069	.....	.....	.....
	Shenango Valley	7,209	4,017	890	.....
	Miscellaneous bituminous	19,674	3,139	338	.....
	Charcoal	3,088	3,046	589	718
Ohio.	Mahoning Valley bitum	13,968	8,343	364	2,503
	Hocking Valley "	1,800	.....	300	.....
	Lake Counties "	10,600	1,671	.....	.....
	Miscellaneous "	750	.....	.....	.....
	Hanging Rock "	9,244	5,793	389	865
	Hanging Rock charcoal	1,915	2,582	250	1,089

The production of Bessemer and low-phosphorus pig iron in 1902 was 10,393,168 tons, against 9,596,793 tons in 1901. The production of basic pig iron in 1902 was 2,038,590 tons, against 1,448,850 tons in 1901, and 1,072,376 tons in 1900. The production of spiegeleisen and ferromanganese in 1902 was 212,981 tons, against 291,461 tons in 1901, and 255,977 tons in 1900. The tables below show the production of Bessemer iron in 1902 by States and in the case of Pennsylvania and Ohio by districts; also the production of basic iron:

PRODUCTION OF BESSEMER AND LOW-PHOSPHORUS PIG IRON.

New York	17,983	48,698	66,681
New Jersey			
Pennsylvania	2,579,439	2,550,583	5,130,022
Maryland	144,750	152,221	296,971
West Virginia	93,297	89,640	182,937
Kentucky and Tennessee	2,855	6,891	9,746
Ohio	1,372,209	1,355,396	2,727,605
Illinois	752,989	742,309	1,495,298
Michigan, Wisconsin, and Minnesota	38,349	43,979	82,328
Missouri and Colorado	104,061	97,519	201,580
Total	5,105,932	5,287,236	10,393,168

PRODUCTION OF BESSEMER AND LOW-PHOSPHORUS PIG IRON IN PENNSYLVANIA AND OHIO.

Pennsylvania.	Lehigh Valley	77,386	38,229	115,615
	Schuylkill Valley	30,902	23,318	54,220
	Upper Susquehanna Valley	3,147	.....	3,147
	Lower Susquehanna Valley			
	Juniata Valley	225,696	178,960	404,656
	Allegheny County	1,551,847	1,571,785	3,123,632
	Shenango Valley	434,597	457,179	891,776
	Miscellaneous bituminous	255,864	281,112	536,976
Ohio.	Mahoning Valley	561,955	531,277	1,093,242
	Hocking Valley	.....	.....	.....
	Lake Counties	344,117	474,990	819,107
	Hanging Rock bituminous	52,568	60,035	112,603
	Miscellaneous bituminous	413,359	489,094	902,653

PRODUCTION OF BASIC PIG IRON, NOT INCLUDING CHARCOAL IRON.

New York and New Jersey	50,994	39,742	90,736
Pennsylvania—Allegheny County	443,901	488,631	932,532
Pennsylvania—Other counties	304,633	291,583	596,216
Virginia and Alabama	179 974	115,217	295,191
Ohio and Missouri	73,772	50,143	123,915
Total	1,053,274	985,316	2,038,590

An interesting table follows, which shows how general was the increase in production last year, as compared with 1901. Alabama, Tennessee and Virginia had increases above the average:

PRODUCTION OF ALL KINDS OF PIG IRON FROM 1899 TO 1902 BY STATES.

States.	Gross tons of 2,240 pounds.			
	1899.	1900.	1901.	1902.
Massachusetts	2,476	3,310	3,386	3,360
Connecticut	10,129	10,333	8,442	12,086
New York	264,346	292,827	283,662	401,369
New Jersey	127,598	170,262	155,746	191,380
Pennsylvania	6,538 878	6,365,935	7,343,257	8,117,800
Maryland	234,477	292,073	303,186	303,229
Virginia	365,491	490,617	448 662	537,216
North Carolina, Georgia	17,835	28,984	27,333	32,315
Alabama	1 083,905	1,184,337	1,325,212	1,472,211
Texas	5,803	10,150	2,273	3,095
West Virginia	187,858	166,758	166,597	183,005
Kentucky	110,019	71,562	68,462	110,725
Tennessee	346,166	362,190	337,139	392,778
Ohio	2,378,212	2,470,911	3,316,425	3,631,388
Illinois	1,442 012	1,363,383	1,596,850	1,730,220
Michigan	134,443	163,712	170,782	155,213
Wisconsin, Minnesota, Missouri, Colorado, Washington	203,175	184,794	207,551	273,987
	138,880	159,204	203,409	269,930
Total	13,620,703	13,769,242	15,878,354	17,821,307

OBITUARY.

Robert Packer Linderman died at his home in South Bethlehem, Pa., Jan. 21, aged 40 years. After graduating from

ROBERT P. LINDERMAN.

Lehigh University, Mr. Linderman was engaged with his father in operating anthracite coal mines until 1885, when he was elected a director of the Bethlehem Iron Co., and in 1890, when only 27 years old, he was elected president. In 1899 he was instrumental in organizing the Bethlehem Steel Co., and was elected its first president.

J. Christopher Summerer, treasurer of the National Iron & Wire Co., Cleveland, died Jan. 24, aged 50 years. Prior to 1891, he was connected with the Van Dorn Iron Works for a number of years.

Ferdinand Protzman, Sr., for many years connected with the steel industry, died at his home in Allegheny, Pa., on Wednesday, Jan. 21, aged 63 years. He was born in Waynesboro, Franklin Co, Jan. 1, 1840. He went to Pittsburg about 1865 and began the publication of the *Iron World*, which was afterward merged into the *American Manufacturer*. When the consumption of tin plate in the United States began to attract attention among some few manufacturers of iron, the publishers of the paper organized a company for the manufacture of tin plate, locating a plant at a point on the Monongahela river, now known as Demmler. The manufacture of tin plate and a high quality of sheet iron began and was conducted with some success for several months, when the British manufacturers cut prices below the cost of American manufacture. Financial difficulties ensued, the result of which was that the publication and property of Messrs. Protzman & Cowan was sold under execution, when it was purchased by the *American Manufacturer*. Mr. Protzman engaged as an employe of the *Iron Age*, later going with the late Jacob D. Weeks to the *American Manufacturer*, with which he was again identified for a number of years. In 1889 Mr. Protzman associated himself with Mr. Adams, the discoverer of what is well known in steel manufacture as the Adams process of making steel direct from the ore, and organized the Iron & Steel Improvement Co., which operated a mill at Indianapolis, Ind., for some time. The late J. C. Blair became associated with the company, and the process was improved by him and became known as the Adams-Blair process. Mr. DePauw, of Indiana, was heavily interested in the enterprise, and when he failed, the company suffered. Since that time the process has been in abeyance, but it was being prepared for introduction at Norwalk, O., and at Hyde, Clearfield county, at the time of Mr. Protzman's death.

Capt. Henry P. Deuscher died at his home in Hamilton, O., Jan. 20, in his 74th year. He was the founder of the H. P. Deuscher Co., manufacturer of agricultural implements, and a number of other enterprises.

Jethro W. Clute died at his home in Schenectady, N. Y. Jan. 21, aged 79 years. For many years he was a member of the firm of Peter I. Clute & Sons, who operated an iron foundry for over fifty years. In the Civil War the engine and boilers for the Monitor were built at this foundry, of which Mr. Clute was then proprietor. He retired from business twenty years ago, devoting his time to caring for his large fortune.

Dominion Iron & Steel Co.

James Ross, president of the Dominion Iron & Steel Co. of Sydney, Cape Brenton, says that the company has not gone on with the construction of the steel rail mill because it was not considered feasible under the present conditions of the tariff. He says, "The mill will be constructed when the government has placed a duty on steel rails that will enable us to cater for our share of the Canadian market. What we need is increased protection all the way from the raw material to the finished product, much the same as has the United States at present."

The directors have decided to build three mills, one for light plates, one for angle-bars and one for wire rods. The earnings of the company for the seven months ending Nov. 30 were $265,035, or $100,000 below fixed charges, interest on floating debt and sinking funds. But these net earnings are practically the result of three months' operation, for it was not until September that the steel project was on a self-sustaining basis. Directors of the company say that the steel company is now earning its charges and preferred stock dividend requirements and something more.

The fifth edition of Brewer & Laubscher's "Ohio Private Corporations" will be issued about March 1. Nearly 100 important changes in Ohio statutes affecting second liability of stockholders, consolidations, franchise tax, preferred stock, cumulative dividends, profit-sharing arrangements with employes, etc., and about one hundred and fifty new Ohio decisions on corporation law during the past two years make the new edition imperative.

THE ANDREW CARNEGIE RELIEF FUND.

Bulletins issued by the Andrew Carnegie Relief Fund were posted Saturday, Jan. 24, at all the works of the Carnegie Steel Co., H. C. Frick Coke Co., and other component interests of the Carnegie Co., exhibiting for the information of the employes a summarized statement of disbursements for the first year of the Andrew Carnegie relief fund, founded with an endowment of $4,000,000 (four million dollars) by Andrew Carnegie for the benefit of Carnegie interest employes who are injured; the dependents of killed employes and the needy superannuated. There is available each year $200,000 for the purposes of the fund. The statement shows that during 1902 the amounts paid out were: Accident benefits, $17,430; death benefits, $15,111; pension allowances, $9,123.05; total, $41,664.05. The payments made on behalf of the other associations and companies which are constituent parts of the Carnegie Co., including the H. C. Frick Coke Co., bring the grand total of payments made during 1902 up to $48,213.85. The total number of accident cases was 257, the death cases 113, and the pension cases 133, making the whole number of beneficiaries of the fund 503.

Mr. Carnegie, in a letter to the president and board of directors of the Carnegie Co., on March 12, 1901, signalized his retirement from business by the creation of this benefaction, placing with the board as a trust $4,000,000 in bonds of the Carnegie Co., bearing 5 percent interest and specifying that the income should be applied:

First: To provide for the employes of the Carnegie Co., in all its works, mines, railways, shops, etc., injured in its service and for those dependent upon such employes as are killed.

Second: To provide small pensions or aids to such employes as after long and creditable service, through exceptional circumstances, need such help in their old age, and who make a good use of it.

In his letter Mr. Carnegie made it plain that he was discharging an obligation to his former employes. He said: "I make this first use of surplus wealth upon retiring from business as an acknowledgement of the deep debt which I owe to the workmen who have contributed so greatly to my success."

The benefaction therefore is not in any sense a charity, Mr. Carnegie considering that the employes have by their service earned the right to the benefits. The life of the trust thus created will be perpetual and self supporting, provision being made to keep the rate of accident and death benefits and pension allowances adjusted so that the total disbursements will not exceed the income, and the endowment will not be impaired at any time. No contributions are required from the employes, or the Carnegie Co.; the entire fund being provided by Mr. Carnegie. The scheme is unique in this respect. Other employes' relief and pension systems maintained by corporations and large employers, which require contributions from the beneficiaries, and in many cases, forfeit of contributions when the employe leaves the company's service.

In the bulletin posted, the regulations governing the granting of benefits and allowances, are made clear to the employes in parallel columns showing the condition under which benefits will be paid and the cases in which benefits will not be paid. While all the employes have the privilege of application, no legal rights to benefits are vested in employes simply because they are such. These regulations are made to preclude applicants whose cases do not conform to the stated conditions, and to protect the fund for the benefit of the deserving employes for whom Mr. Carnegie intended it. The Advisory Board has adopted a rule not to consider any application on account of disablement prior to Jan. 1, 1902, upon which date the regulations became effective.

The plan evolved for the administration of the trust is principally the work of Chairman Charles L. Taylor and Manager F. M. Wilmot, who devoted months of study to the subject, investigating every system of workingmen's relief and pensions known to exist in this country and Europe. However, none of the schemes studied afforded a plan applicable to the requirements of Mr. Carnegie's proposition. Mr. Wilmot, to whom the business management of the Fund has been entrusted, was for eleven years with the Pennsylvania Railroad, and is experienced in the detail operations of a business of this character. The fund will be administered by an advisory board appointed by the directors of the Carnegie Co., under the president of that company, and is composed as follows: Charles L. Taylor, chairman; Homer J. Lindsay, vice chairman; Thomas Morrison, Thomas Lynch, D. G. Kerr and E. H. Utley.

In creating this trust it was not the purpose of Mr. Carnegie to relieve the various companies of their obligations to indemnify employes injured in the service or care for the dependents of those killed, as the companies have been accustomed to do, but he desired the benefits paid from the fund to be in additions to the compensations paid by the companies in such cases. In this connection the statement is made of the Carnegie Steel Co., that in all the years of its existence during which hundreds of workmen have been maimed and killed in its works, only about a dozen claims for damages have gone to final decision in the courts, and of this number the company was awarded the verdict in the majority of cases because the claims were manifestly unjust.

The policy of the company is to deal liberally with its injured employes and the survivors of the killed, and it has paid vast sums in accident benefits and allowances to those whose bread winners were taken from them in steel works disasters. Mr. Carnegie touching upon this matter said: "The fund is not intended to be used as a substitute for what the company has been in the habit of doing in such cases. Far from it. It is intended to go still further and give to the injured or their families, or to employes who are needy in their old age, through no fault of their own, some provision against want as long as needed, or until young children can become self-supporting."

The Fritz Gold Medal.

At a meeting of the Fritz Memorial Committee, held in New York on Jan. 23, the announcement was made that the four national engineering societies have appointed the following as their representatives on the board of trustees of the Fritz Medal:

American Society of Civil Engineers.—J. James R. Croes, New York, one-year term; Robert Moore, two-year term; Alfred Noble, New York, three-year term; Charles Warren Hunt, New York, four-year term.

American Institute of Mining Engineers.—E. E. Olcott, New York, one-year term; E. G. Spilsbury, New York, two-year term; James Douglas, New York, three-year term; Charles Kirchhoff, New York, four-year term.

American Society of Mechanical Engineers.—Gaetano Lanza, Boston, one-year term; John E. Sweet, Syracuse, N. Y., two-year term; Robert W. Hunt, Chicago, three-year term; S. T. Wellman, Cleveland, four-year term.

American Institute of Electrical Engineers.—Arthur E. Kennedy, Cambridge, Mass., one-year term; Carl Hering, Philadelphia, two-year term; Charles P. Steinmetz, Schenectady, N. Y., three-year term; Charles F. Scott, Pittsburg, four-year term.

A preliminary organization of the board of trustees was effected and a committee was appointed to plan for a permanent organization.

The pipe foundry of the U. S. Cast Iron Pipe & Foundry Co., West Superior, Wis., will resume operations in March. When the plant shut down last spring there was a large supply of pipe on hand. This has been sold and further orders received—enough to guarantee opening the plant.

The Colorado Fuel & Iron Co. has obtained water rights to about 5,000 acres of land purchased from the Arkansas Irrigation Co. This purchase is one of considerable importance.

SOME IMPROVEMENTS IN CHUCKS.

Some of the recent improvements introduced by the Westcott Chuck Co., of Oneida, N. Y., are illustrated in the accompanying illustrations. Figs. 1 and 2 show the patent spur-geared scroll combination lathe chuck, which will appeal to the eye of the mechanic because of its straight line connection from wrench to chuck jaw. The power which is applied to produce the universal movement of the jaws is transmitted by a strong spur pinion which engages with a spur gear cut on the edge of the steel scroll. The spur pinion is operated by a drop

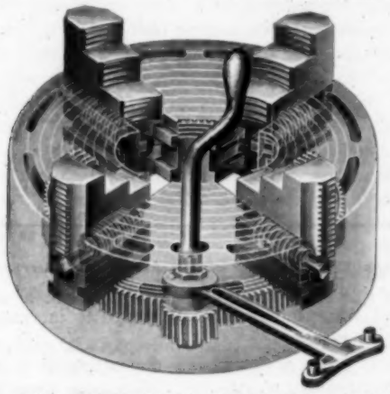


FIG. 1.—SPUR GEARED SCROLL COMBINATION LATHE CHUCK.

FIG. 2.—SPUR GEARED SCROLL COMBINATION LATHE CHUCK.

forged open end wrench, which is inserted through an opening in the side of the chuck and engages with a hexagon pinion shaft. This may also be operated from the face of the chuck by a key fitting a square socket in the end of the pinion shaft.

In all other respects the chuck is the same as the well-known form of scroll combination chuck manufactured by the same company. The scroll may be rapidly manipulated by a lever engaging directly with it at the back as in the old chuck, and increased gripping power then gained by applying the open end wrench to the spur pinion. The increased grip is not only due to the fact that a spur gear is employed, but may be fairly credited to the use of an open end wrench under very favorable circumstances for applying the power. The acute lathesman will also appreciate the possibilities in the bringing of a corner of the wrench in contact with the lathe bed, a method to which some exception may be taken, but allowable if handled with the safety valve of workmanlike judgement.

It is worthy of notice that the mechanism by which the universal movement of the jaws is produced may be operated from the face and edge of the chuck as well as from the rear. The chuck does not require any shifting in and out of gear, but is always ready to be operated either independently or universally at will. The jaws are reversible. The chucks are manufactured in nine sizes, taking from 12 inches to 43 inches inside of the jaws.

Another improvement is illustrated in Figs. 3 and 4, which show a novelty in a somewhat well-worn field. This is the auxiliary screw drill chuck; Fig. 3 showing the assembled chuck, and Fig. 4 the view illustrating the parts in detail. It is evident that in drill chucks with screws acting at the side, the inner or gripping part of the jaws will have a tendency to crowd away from the right and left hand screw, and the outer end of the jaws has a movement toward the right and left hand screw. The auxiliary screw in this recently patented chuck brought out by the Westcott Chuck Co. is designed to overcome such a tendency.

The construction of this device will be readily understood by an examination of the half tones, and it will be seen that after closing the jaws on the drill in the usual manner (by turning the right and left hand screw), the auxiliary screw is tightened. This will greatly increase the gripping power of the chuck, as the effect of the auxiliary screw is similar to that of a bolt, as it virtually clamps the two jaws together. These improved chucks are made in a variety of forms and sizes.

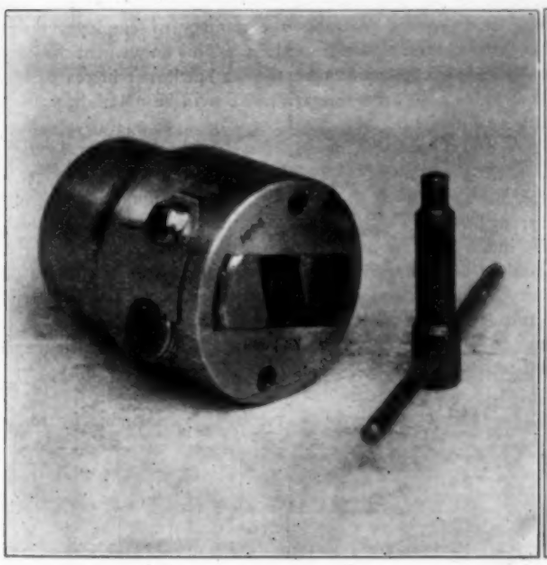


FIG. 3.—AUXILIARY SCREW DRILL CHUCK.

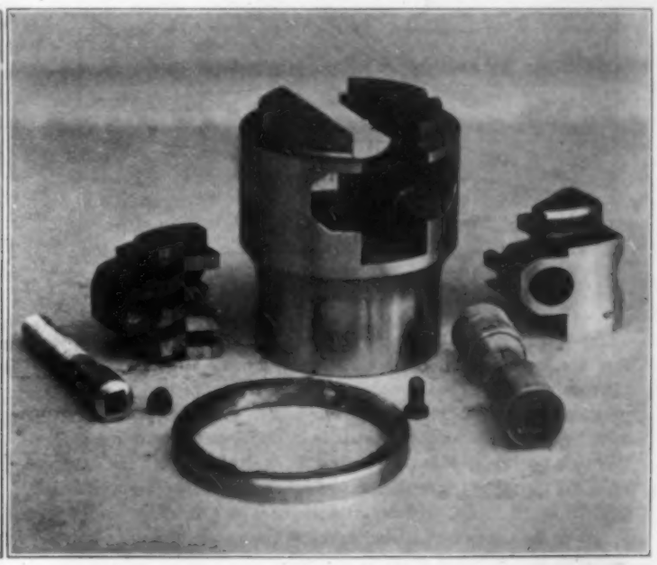


FIG. 4.—DETAILS OF THE AUXILIARY SCREW DRILL CHUCK.

A meeting of manufacturers who are interested in the proposed consolidation of companies producing emery wheels will be held at the Fifth Ave. hotel, New York, Jan. 29. Among the concerns to be represented are the Carborundum Co., Niagara Falls; Abrasive Emery Co., Detroit Emery Wheel Co., and Safety Emery & Corundum Co.

IRON AND STEEL EXPANSION IN THE UNITED STATES.*

BY SIDNEY GRAVES KOON.

In a recent bulletin of the twelfth census of the United States, are to be found indications of the marvelous expansion of the nation in this most important branch of industry. The general character of the expansion, taking the iron and steel manufactures as a whole, is shown in Table I, and graphically in Fig. 1.

TABLE I.

	1870	1880	1890	1900
Number of establishments	808	792	719	669
Capital	$121,772,074	$209,904,965	$414,044,844	$590,530,484
Average	$150,693	$265,005	$575,862	$882,706
Total employes	77,555	140,798	175,506	231,824
Average	96	178	244	347
Salaries and wages	$40,514,981	$55,451,510	$95,736,192	$132,578,126
Average	$522	$394	$545	$572
Cost of materials used	$135,526,132	$191,271,150	$327,272,845	$522,431,701
Miscellaneous expenses	$7,130,000*	$10,720,000*	$18,214,948	$32,274,100
Value of products	$207,208,696	$296,557,685	$478,687,519	$804,034,918
Gross profits	$24,037,583	$39,115,025	$37,463,534	$116,750,991
Tons (2240 lbs.) of products	3,263,585	6,486,733	16,264,478	29,507,860
Tons per plant	4,117	8,189	22,621	44,107
Tons per operative	42.08	46.07	92.67	127.29
Pounds per capita (United States)	189.6	289.7	581.8	866.3

*Estimated from figures for 1890 and 1900.

The decrease in the number of plants is but one evidence of the great concentration of energy and combination of capital

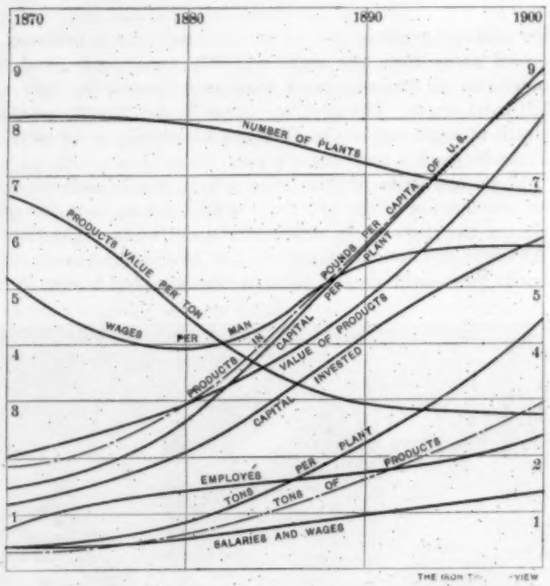


FIG. 1.—IRON AND STEEL EXPANSION FROM 1870 TO 1900.

which have so recently startled the world. Other evidences of this are found in the figures and curves for the capital per plant, the number of employes per plant, and the tons of product per plant. The last-mentioned item is also a function of the mechanical progress made in the industry, entirely aside from all economic ideas, including, as it does, results obtained from the continued introduction of labor-saving machinery and devices of all kinds. That this feature is not at all imaginary is shown by the fact that the largest locomotive-building establishment in the world recently increased its capacity for output by 20 percent, simply as a result of installing the electric drive for its machines, thus permitting a far more extensive use of overhead traveling cranes than was otherwise possible.

The increase of capital per plant in the thirty years under consideration from $150,000 to $880,000, represents a gain of 486 percent, employes per plant have in the same time increased but 262 percent, a part of the difference being representative of the extent to which labor-saving mechanisms are being utilized, while the rest of the difference is doubtless due to the appreciation in the value of the lands upon which the plants are located. Perhaps the best way to get at the influence of these mechanical aids in the industry is to observe the rapid increase in the number of tons of product per operative. The figure now stands at fully three times its value of thirty years ago. It will be noted that during the first decade under review this quantity increased but slowly; in the next decade

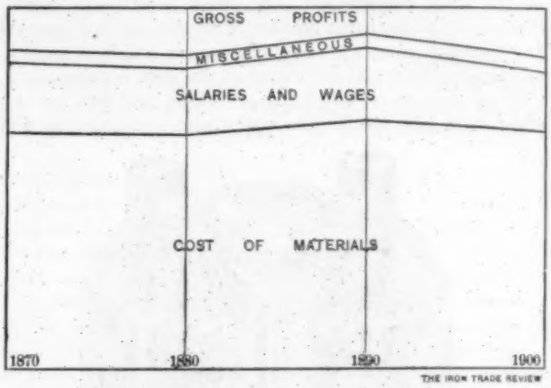


FIG. 2.—VALUE OF PRODUCTS IN COMPARISON WITH INVESTED CAPITAL

it doubled, while it has since continued to increase at a very considerable rate.

The next point which claims our attention is that of the capital invested in the industry. Increasing from $120,000,000 in 1870 to $590,000,000 in 1900, or 385 percent, this has kept far ahead of the population of the United States, which, in the same period, increased from $38,558,000 to $76,303,000, or 98 percent. A fairer comparison, however, would be between the capital invested in this industry and the wealth of the nation, the latter figure representing to a certain extent the capital invested in *all* industries. For 1870 the wealth of the United States may be placed at $27,000,000,000, which was increased to $90,000,000, 000, in 1900, or a gain of 233 percent. The capital invested in the manufactures of iron and steel in 1870, per million dollars of national wealth, was $4,515; in 1900 it was $6,560, which is greater by $2,045, or 45 percent.

In spite of the enormous savings made by the introduction of labor-saving appliances, the demands of the industry have made it necessary to treble the number of employes during the thirty years under inspection. This movement has naturally been accompanied by a similar but larger increase in the total wages paid these operatives. It will be noted, both in the table and in the diagram, that the wages per operative suffered a severe set-back during the decade from 1870 to 1880. It should be explained that this check is more apparent than real, for the reason that in 1870 we were upon a depreciated currency basis, with resultant inflation in prices and values of all kinds. This fact affects, for the year 1870, every item or expenditure or value mentioned, with the exception of the percentages of the value of the products represented in the various manufacturing costs, the value of products based upon the amount of capital invested, and any other ratios which may be instituted between two quantities, both of which are represented in dollars and cents.

The value of products has reached an enormous figure, and

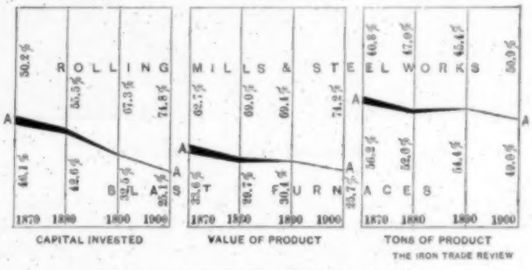


FIG. 3.—PERCENTAGE OF VALUES.

the shape of the curve seems to indicate a continued rapid expansion for the future. The figures have not advanced so markedly, however, as have those for capital; the latter having quintupled during the thirty years, while the former have quadrupled. A relation between these quantities is seen in

*From the Sibley Journal of Engineering.

Table II, where the value of the products is given in comparison with the capital, per $100 invested; and graphically in Fig. 2.

TABLE II.

	1870	1880	1890	1900
Value of products per ton	$63 49	$45 72	$29 43	$27 25
Value of products per $100 capital	170 16	141 28	115 51	136 16
Gross profits, percent of capital	19 80	18 63	9 05	19 79
Percent of value in products in				
Salaries and wages	19 55	18 70	20 00	16 49
Materials	65 41	64 50	68 37	64 98
Miscellaneous	3 44	3 62	3 81	4 02
Gross profits	11 60	13 18	7 82	14 51

The principal single item included in the value of the products is that of materials used. This forms some 65 percent of the whole, and is seen to bear to that whole an almost constant ratio. The item of next magnitude consists of salaries and wages, the proportion of which to the total figures remained nearly constant until 1890, since when it has fallen considerably, in spite of the fact that during the decade the wages per man have increased 5 percent. The decrease is thus seen to be due to a *relative* decrease in the number of men employed, resultant upon the use of the labor-saving devices already mentioned. The miscellaneous expenditures were listed in the report, for 1890 and 1900 only; the figures for the other two periods were obtained from those given by assuming that the acceleration in percentage of value of product has been constant. The difference between the sum of the three items above mentioned and the value of the product may be called "gross profits," representing the excess of value over cost of product ready for market. To obtain the net profits, however, it would be necessary to deduct from this figure the cost of

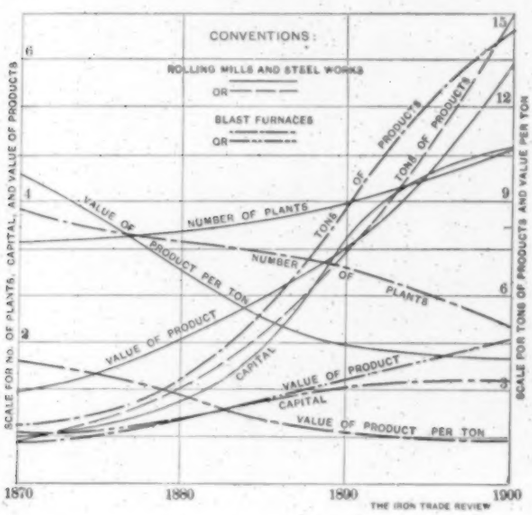


FIG. 4.—THIRTY YEARS' PROGRESS IN PLANTS, CAPITAL AND PRODUCTS

placing the products upon the market, including advertising, selling agents' commissions, etc., etc.

As a last division of this part of the subject, the amount of the product in tons is worthy of serious consideration. Increasing from 3,260,000 in 1870 to 29,500,000 in 1900, the figure is seen to have more than doubled, on the average, with each decade. The total increase has been quite 800 percent. Comment has already been made upon the remarkable increase in the product in tons per plant, where, owing to the decreasing number of plants, a much higher ratio of increase is maintained than that for total tonnage. The latter figure allows of another interesting comparison,—that with the population of the United States. A little analysis shows that the output per head has increased from 190 pounds in 1870 to 866 pounds thirty years later, a gain of 358 percent. This is indicative of the tremendous augmentation in the consumption of iron and steel which the United States has undergone during the last third of a century. Coincidently with this increase has come a most decided fall in the average price per ton of product—from $63.49 in 1870, to $27.25 in 1900. This is due partly to more economical management, partly to improvements in the methods of manufacture, and partly to the effects of consolidations which account largely for the first cause given.

It is now pertinent to examine the distribution of the various items of capital, product, etc., among the several subdivisions of the industry. To this end, Table III has been prepared, showing the values of the quantities mentioned, as applied to (1) blast furnaces; (2) rolling mills and steel works; (3) forges and bloomeries. In this connection the diagrams in Fig 3 show the percentages under each item as distributed. It will be noted that the ratio represented by the third subdivision is very slight, being shown by the varying thickness of the lines *AA*, separating the other divisions. This being relatively so unimportant a branch of the industry, it has been omitted from the set of curves shown in Fig. 4, which represent the progress of thirty years in number of plants, capital invested, value of product, tons of product, and value per ton.

TABLE III.

	1870	1880	1890	1900
Blast Furnaces:—				
Capital invested	$56,145,326	$89,531,362	$134,608,542	$148,226,113
Value of prod.	$69,640,498	$88,204,010	$145,612,983	$206,579,400
Product in tons	1,832,876	3,375,912	8,845,185	14,452,234
Average price	$38 00	$26 13	$16 46	$14 29
Rolling Mills and Steel Works:—				
Capital invested	$61,120,015	$116,458,390	$278,559,831	$441,795,983
Value of prod.	$129,921,144	$203,274,042	$331,860,872	$596,689,284
Product in tons	1,331,773	3,046,038	7,388,244	15,040,129
Average price	$97 56	$66 73	$44 90	$39 67
Forges and Bloomeries:—				
Capital invested	$4,506,733	$3,915,213	$876,470	$508,388
Value of prod.	$7,647,054	$3,968,074	$1,183,494	$522,432
Product in tons	98,936	64,783	31,049	15,497
Average price	$77 29	$61 25	$38 12	$33 74

Taking up first the subject of blast furnaces, we find a continued increase in the amount of capital invested, a somewhat greater increase in the value of the product, a much more rapid one in the tons of product, and a decided fall in the price per ton, as also in the number of plants. In the first instance, the ratio of increase is 164 percent, to which the last decade has failed to contribute its due share, thus indicating a gradual relative falling off. The value of the product has increased by 197 percent, and here the last decade has about kept pace with the average of the other two, its figure being 42 percent, as compared with 26.7 and 65, respectively. As to the product in tons, the increase has been enormous, amounting in thirty years to no less than 688 percent. In each decade, the value has about doubled over the figure for that preceding, the ratio of increase for the last ten years being slightly less, or 64 percent. In the price per ton of product, the greater part of the fall took place before 1890, at which date the figure was 56.7 percent less than in 1870. Since 1890 the fall has been much more moderate, amounting to only 13.2 percent.

As to rolling mills and steel works, we find the same general trend of changes as with the blast furnaces, except that the number of plants has increased, instead of diminishing. This is the more significant inasmuch as the total number of establishments in the United States engaged in the manufacture of iron and steel has suffered a decided fall. The plants under present consideration have increased from 340 in 1870, to 358 in 1880, 395 in 1890, and 438 in 1900, a total increase of 98, or 28.8 percent. In this same period the total number of establishments has decreased from 808 in 1870, to 669, or 17.2 percent. It is thus seen that the number of plants outside of rolling mills and steel works has decreased from 468 in 1870 to 231 in 1900, or more than one-half. Forming only 42 percent of the whole number in 1870, the rolling mills and steel works have so increased that they now form 65.6 percent of all.

The capital invested has increased during the thirty years from 1870 to 1900 by 623 percent. The value of the product has not kept pace with the capital, its ratio of increase being only 359 percent, to which the last decade has contributed more than its proportional share, the increase being 80 percent as against 58.6 percent for capital. The value of product per $100 of capital invested, which was $213 in 1870, became $175 in 1880, $119 in 1890, and $135 in 1900. The product in tons has shown an even more marked increase than did that for blast furnaces. From 1,330,000 tons in 1870, to 15,000,000 in 1900, represents an increase of 1,030 percent. The quantity has been more than doubled with each decade, the ratios of increase being respectively 129, 142, and 104 percent. As with the products of the blast furnaces, the greater part of the 59.3 percent drop in the price per ton is chargeable to the first two decades under consideration, the fall for that period

being 54 percent, while for the last ten years it has been 11.6 percent.

In the detailed statement of the products of rolling mills and steel works, one of the most striking features is that of iron and steel rails. The former have decreased from 417,000 tons, valued at $21,000,000, in 1880, to 880 tons, worth $31,180, in 1900; the price per ton falling from $50.32 in 1880 to $35.43 in 1900. During the same period the production of steel rails increased from 670,000 tons, valued at $39,900,000, in 1880, to 2,250,000 tons, valued at $46,500,000, in 1890; the price per ton having fallen from $56.54 to $20.66, which was far below that for iron rails. It is interesting to note that $20.66 was also the price of gold in 1900, the unit of measurement being the ounce, instead of the ton. Of the 2,250,000 tons produced in 1900, 600,000 weighed upwards of 85 pounds per yard, 1,500,000 between 45 and 85, and 150,000 below 45.

Two other items in the production for 1900 claim attention, because of their high value per ton. These are direct steel castings, of which 177,156 tons, valued at $14,609,893 were produced, at an average value of $82.47 per ton; and armor plate and gun forgings, of which the production was 15,302 tons, valued at $7,526,479, or $491.66 per ton.

Considering steel works alone, the production in 1900 was 10,685,000 tons, valued at $212,500,000. Of this amount 10,507,844 tons, valued at $197,000,000, were ingots; the balance was made up of 177,156 tons of castings, valued at $14,609,893.

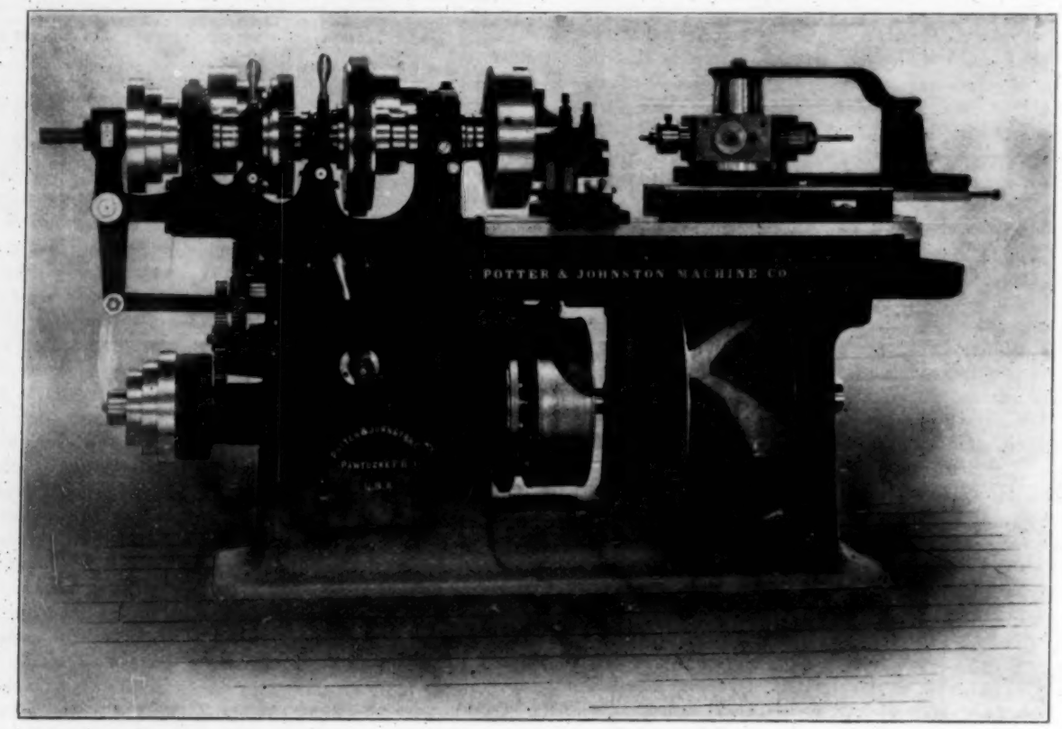
The headquarters of the American Bridge Co. have been transferred from New York City and Pencoyd, Pa., to the fifteenth and sixteenth floors of the new Pennsylvania Bldg., at Fifteenth and Chestnut Sts., Philadelphia. Nearly all the executive officers are already in Philadelphia, and about 200 clerks will be at work there before Feby. 1. The notices issued by the American Bridge Co., Alfred J. Major, president, announce that the offices of the president, assistant president, vice president, president's staff, engineers' and auditors' departments and purchasing agent will be moved from Pencoyd, and that the Fourth St. offices in Philadelphia will also move, to be followed by the treasurer, who will come from No. 100 Broadway, New York. There is to be no change in the secretary's office, nor of the division offices.

The Crucible Steel Co. of America, 71 Broadway, N. Y., has taken a trial order for crucible steel for tools to be used by the Bengal & Northwestern Railway, India.

AUTOMATIC CHUCKING AND TURNING MACHINE.

The cut shown herewith represents the latest improved automatic chucking and turning machine which has recently been placed upon the market by the Potter & Johnston Machine Co., of Pawtucket, R. I. The machine is arranged for the automatic working of all kinds of castings up to 10 inches diameter and 6 inches long. It possesses several new and very useful features not common to this particular class of machinery.

The turret has five sides, with 2½ inch holes, and it withdraws, revolves and advances at forty times the feeding speed. The feed is driven and controlled by the spindle. The cross slide can be operated automatically at any time in conjunction with the turret. The turret slide is operated by a large cam drum driven by spur gearing, the power being applied near the periphery of the drum. This arrangement is very substantial and prevents any spring of the working parts. The cross slide tool blocks have a travel of 4½ inches in each direction, and have screw adjustment on cross slide. The standard set of cams furnished with the machine covers all ordinary pieces up to 6 inches long and requires no adjustment. The automatic back facing attachment shown in the cut is a very valuable addition to the machine. This attachment enables the hubs of gears, pulleys, etc., to be finished on both ends at one setting, and in this manner a large variety of pieces which would ordinarily require to be done in two holdings, can be finished complete at the one setting.



A NEW AUTOMATIC CHUCKING AND TURNING MACHINE.

Another very interesting feature in connection with the machine is the automatic chuck. By the use of this device pieces which can be handled with one hand can be placed into the chuck and removed without stopping the spindle, thus the machine is running all the time, and requires very little attention from the operator, hence he can readily run from four to eight machines, according to the class of work being done, making the labor cost of production a very small item in comparison with the increased product obtained. While, of course, automatic chucking machines show up their true value to better advantage when run in groups of half a dozen or more machines, yet if a concern has not a sufficient amount of work to keep several machines going, as the machine requires so little attention, it can easily be run in connection with some other machine, say an engine lathe or turret machine, and the additional product obtained upon the automatic chucking machine is secured without extra labor cost.

A heavy scroll chuck is furnished with the machine for gripping extra heavy or eccentrically shaped pieces. A pair of universal turning and facing tools is furnished as part of the standard outfit of the machine, and takes care of all ordinary pieces up to 10 inches diameter. The machine is made in three types, viz.: either with geared automatic change speed head, with belt driven change speed head, or with plain head. With geared automatic change speed head, the spindle is driven by two trains of spur gears, each train having four changes of speed; with the belt driven automatic change speed head, the spindle has four changes of speed, and with the plain head machine the spindle is constant, but has four grade cone.

The leading specifications of the machine are as follows: Swing over bed, 17 inches; swing over cross slide, 10 inches; travel of the cross slide each way, 4½ inches; diameter of the holes in turret, 2½ inches; front spindle bearing, 3 9-16x7 inches; rear spindle bearing, 3¼x5 inches; net weight, 5,800 pounds.

FREE SHOPS FOR FREE WORKINGMEN*.

BY W. H. PFAHLER.

The recent rapid increase of membership in labor unions has brought to the front the demand for a "union shop," which is being forced upon the employer whenever and wherever he is too weak to resist it. The manufacturer or employer of labor who resists this demand is said to have an "open shop;" and it is well to consider this feature of the struggle between employer and employe, with regard to the conditions created, and without sentiment or sympathy for either side.

An "open shop" is a term quite common among employers, but it would have no significance were it not for this demand of the labor union, to close the shop to all but union men, and prevent the employer from hiring *free men*, who prefer to control the sale of their own labor according to its value, rather than at a price fixed by a body of men whose purpose is to create a standard of wage based upon the ability of the incompetent workman, or more frequently the emergency existing at the time such wages are fixed. The union claims that the efficient or skilled workman will always receive more than the standard wage; and while this may be true, so long as there are no more workmen in any craft than are required, when the condition changes so that there is a surplus of men, the incompetent is discharged, the wage of the skilled man is reduced to the standard which was fixed on a false basis, and often even lower than that, while the place of the incompetent workman is supplanted by machinery. It is for this economic reason that a very large number of the best mechanics refuse to join a union, preferring to remain *free men* until *forced* by "persuasion," which is the only means allowed by the laws of the union, but which may be physical if moral will not answer the purpose.

The last resort of the union in this direction is to demand a "union shop," so that the employer shall assist them in their persuasive purposes by refusing employment to a free man, or by discharging such a man if he continue to refuse to join the union. It is this action on the part of the union that compels the employer who prefers to make no distinction as to his employes, other than such as follows natural laws in the purchase of labor, to contend for an "open shop," often at great cost and severe loss to himself, to maintain that condition, regardless of the union demand. That he is right in doing so cannot be questioned, because it is the true American condition that every man should be, and is, free to seek employment wherever and under whatsoever conditions he may prefer, without regard to his politics, his religion, or his affiliation with organizations based on principles which he cannot endure.

The opposition to the labor union today is not the objection to organized labor, but to the methods employed by unions to force conditions and create ideals conceived frequently without due knowledge of existing facts, and more especially to the secrecy in which all their plans are made and executed. The opposition of the employer to labor unions does not arise from any desire to prevent the accomplishment of their efforts toward the improvement of the condition of the workingman; the intelligent employer knows full well that the highest efficiency can be attained by such improved conditions, but he does object to the attempt of the union to sustain in secret, by approval and applause, unlawful acts on the part of its individual members, even though they are denounced in public, and claimed to be contrary to the laws of the union.

I have yet to find a rule of any union which provides for the punishment or expulsion of a member because of any criminal act that he may commit, even though convicted before a jury, if such act has been exercised against an employer who has refused to grant the demands formulated by the union, in secret conclave. While on the other hand, I do know of cases where the union, out of funds contributed by the membership, has paid fines of large amounts inflicted upon its members by courts before whom they have been convicted for crime committed against the employer or some *free man* who refused to remain idle at their dictation.

Another mistake of labor unions is that they endeavor to think and work along one line only; that is, to define and demand the rights, as they conceive them, of the workingman, but never attempt to define his duties; to define the pay of the workingman, without defining the equivalent in labor he should furnish for such pay. This is the fact to such a large extent that the employer can very easily see in the action of the union the embodiment of sentiment and so-called principle, which cause them to say, or at least imply by their actions, that the employer has no right which the union is bound to respect.

I have outlined these conditions of the labor union as they exist and are presented to the employer that I may more clearly give you his reason for opposing the "union shop" and refusing to become a party to the attempt to create such conditions, while at the same time he may be in favor of organized labor, and not only ready, but anxious, to confer at all times with its representatives upon any subject which is within its jurisdiction, and the consideration of which will result in mutual benefit to employer and employe.

The difference between a "union shop" and an "open shop" can be clearly defined as a difference in management. The union, without invitation, with no endorsement as to its qualification, for no ostensible reason except to exercise accidental power, attempts to limit the owner or employer in the exercise of his right and judgment as to the proper use of that which is his, and limit the workingman to the dictation of a walking delegate or shop committee. While the "open shop" is free to all, the union as well as the non-union man, and places no restrictions on the employe which he is bound to accept.

The demand for a "union shop" have never been, in any case in which I am familiar, accompanied with a proposition for benefit to the employer, except perhaps that he may, by conceding to the demand, hope to avoid the persecution of the local union to which his men belong.

On the other hand, the change from an "open shop" to a "union shop" gives the union entire control. And if the members, in secret conclave, decide, because of a hot-headed leader, to enforce a rule in the shop which is unwise, unfair, and detrimental to the interests of the employer, the ultimatum is a strike, the closing of the shop, and loss in time, money, and often property. Is there any wonder that the employer elects to have the strike which preserves his liberty rather than that which must be made to restore his liberty?

The demand for the "union shop" presents to the employer the following dangers which are incorporated in the written or unwritten laws of almost every labor union: The surrender of the privilege of selecting his employes to a committee who recognize no standard of efficiency but membership in the union. "No card, no work" is the rule. The necessity of discharging old and faithful employes who claim to be free men and refuse to join the union. The discharge of foreman or superintendent who, in the performance of his duties, may offend the walking delegate or shop committee. The limitation of apprentices to a ratio established by the union, in many cases fifty or more years ago, and retained in force regardless of any change of conditions or requirements. The opposition to the introduction of labor-saving machines, designed in most cases to relieve the strain of labor for the skilled man and increase his efficiency with reduced energies, as well as to in-

*A paper read at the meeting of the American Economic Association, December 29, 1902.

crease production in ratio to the wants of an increased population, and reduce the cost to the customer. The limitation of the earning capacity of the industrious and ambitious workingman to the standard of the lazy and incompetent. The obstruction to every plan of premiums or promotion which may encourage a workingman to increase his skill and better his condition. The limitation of output by every means in the power of the union, on the principle that if every man will do less there will be more for every other man to do.

I am sure the leader in labor movements will promptly deny that the union stands for anything that I have enumerated, and I am willing to admit that some of them with whom I had negotiations are opposed to every unlawful or unwise action of the union over which they preside, and have denounced such acts as freely as I do; but they cannot, or will not, exercise the power to prevent them, because under the unwritten laws they are considered fair and right.

It has been well said by a noted economist: "Without impugning the motives of leaders or factors who have brought them about, it is widely felt that the mere existence of vast consolidation, whether of men, money, or power, has in it the possibility of mischievous, if not disastrous, results, and the impulse to restrain them by law is undoubtedly growing, and will ere long bear fruit."

One of the greatest mistakes of labor unions, as shown in the demand for a "union shop," is the belief that the present rapid increase in numbers is an endorsement of the principles and acts of the union; but in this I am sure the leaders are mistaken, because in times like the present the idea of consolidation or co-operation to secure any purpose is rampant, and men flock to any standard, whether right or wrong, if it suggests a change and the promise of future benefit is announced in loud tones, just as a million of voters a few years ago followed the lead of a man who would have wrecked the entire financial condition of the country, because he went through the land with thundering tones, telling the workingman that free silver was the change he needed to improve his condition.

The real hard fact, as seen daily by the employer, is that the numerical strength of most unions is in ratio to the force employed in recruiting rather than of free will on the part of those that join. Thousands of good, honest workmen join the union to purchase, at small cost, freedom from insults; to protect their families from ostracism, and themselves from bodily injury.

In addition to this, many more thousands are driven into the union by the unwise actions of employers who deny the right of labor to organize for its own benefit and refuse to confer with employes or their representatives upon such questions as may be of benefit or mutual interest. The very best recruiting agent for labor unions today is the proud, defiant, egotistic employer, or accidental corporation manager, who shouts continually, "I have nothing to arbitrate!"

I make these statements from an employer's standpoint, based upon practical observation, and if I am wrong in any particular it is because of the secrecy with which unions are conducted; until that secrecy is removed they must be content to be measured by the things they do, and not by what they profess to do. I make these statements, not as the enemy of organized labor, but as its warmest supporter. I also advocate organization of employers, and gladly see such organizations springing into existence.

The earliest associations of manufacturers were formed for "defense against the unjust demands of labor unions." Today the object is to promote just and equitable dealings between employer and employes. When these great organizations of employers on one side and employes on the other meet to contest their supposed rights, or carefully formed demands, they will be compelled to recognize that greater organization, the American public, who is determined that contents of this nature must be settled with due deference to its rights, and that future attempts to stop the wheels of progress shall meet the fate they deserve.

I favor organization. Having been closely in touch with progress along these lines, I feel sure that the day is near at hand when labor leaders who stand for justice and equity between employer and employe will have the honest support of all employers. The result will be a "union shop" for which no demand need be made; a "union shop" which means union between capital and labor; which means harmony and profit for both; but more than that, a union which, by its combined co-operation, will conquer for this country the markets of the world.

THE VALUE OF METHODS OF APPROXIMATION.*

BY JOSEPH R. WORCESTER.

By far the most important part of engineering is the making of designs of one kind or another. Engineering also includes the observation of facts, and analyzing, arranging and digesting the facts observed. Another important duty of the engineer is taking charge of the execution of work in accordance with his designs; but the chief use of the engineer, and that in which his services are indispensable, is in designing. One of the requirements for admission to the American Society of Civil Engineers as a full member is that the candidate "shall be qualified to design as well as to execute engineering works."

The part of engineering which consists of observing, belongs chiefly to the surveyor, and the collation and digestion of observations belongs to the computer and scientist or mathematician.

The execution of designs often requires engineering skill, but this is not usually the case unless unforeseen contingencies are likely to arise, which can be met only by one qualified to modify the design in an emergency. Merely carrying out a design already prepared can be safely entrusted to the inspector and superintendent. They can interpret the plans and specifications and they can see that proper materials and workmanship are employed; but, when the unforeseen happens, when, in excavating, quicksand is encountered; or, when, in building the arch, the center begins to settle, or, when, in transporting a steel structure, it meets with a railway accident and some of the parts are bent; on such occasions there is apt to be a hurry call for the engineer.

What the engineer, and no one else, can decide, is how work shall be done; what assumptions shall be made with regard to probable forces to be encountered; what loads and stresses it will be safe to allow on different materials. His general foresight is required to determine the most effective, and at the same time, economical way of accomplishing the end.

In all this work, which is most truly engineering, methods of approximation are of the utmost service, and, in a surprisingly large proportion of cases, absolutely essential.

There is a widespread notion that engineering is a profession which deals with facts, and that its work is accomplished with mathematical precision; but this is only true in a relative sense. Possibly the engineer knows more precisely what he is doing than a clergyman or a physician, and can be more certain of attaining his desideratum. This may even be true with regard to a lawyer. The reason is that he deals with matter rather than mind, and matter is fortunately not so liable to freaks as mind. It is not, however, entirely free from freaks, or from circumstances, which, to our human intelligence, appear to be such, and, in dealing with freaks, exact methods are dangerous.

For example, an engineer is called upon to design a culvert through a railroad embankment to take care of a brook draining a certain tract of land. He may be supplied with the information obtainable from a long series of observations, as to the height which the water has reached in the brook previously. "The oldest inhabitant" can tell him exactly how high the water reached in "the great freshet of ——." He may know the area of the water shed, and be supplied with a mass of information as to rainfall and weather conditions; but if he makes the capacity of the culvert exactly right for the worst known conditions; and fails to provide for freaks, such as the culvert being jammed with ice or debris, a cloudburst, the breaking of a dam further up-stream, or nobody knows what, he may get into trouble.

Or again, suppose an engineer is called upon to design

*From the Harvard Engineering Journal.

a simple roof truss for a flat roof, and he were to assume that the maximum load that could come upon it were a snow load of perhaps twenty-five pounds per square foot, which, theoretically, would be ample, and a few years hence it should be found to be a point from which a foot-ball game or a procession could be viewed. Would he not thank his stars that he had not followed exact methods of calculation?

In another way, also, exact methods are sometimes dangerous. An engineer always regards with suspicion figures which are carried out to too many places. A survey in which angles are given to seconds, when the degrees are wrong, is much worse than one in which seconds are disregarded and the minutes are right. The chief engineer of one of the largest bridge companies in this country once said to the writer, that when one of his assistants brought into him an estimate with the weight given to the last pound, he always said, "Never mind the pounds; are the tons right?" It is no uncommon experience to find calculations made with extreme nicety, when the computer has forgotten to multiply by two, or even has mistaken the position of his decimal point. The effect of refinement in figures is often to obscure the main issue, and methods of approximation are much safer.

But aside from the dangers of exact methods, they can rightly be applied only to an extremely limited number of problems. Unless the data upon which the work is based is exact, no amount of accuracy in carrying out the deductions will avail to make exact results. For an illustration, we may take the case of a simple girder for a railroad bridge. We may know how to calculate the strains from given loads (though possibly we do not), but let us see how near we are to obtaining an exact solution of the problem. In the first place, as to the loads: We know the weight of the heaviest engine now in use on the road and the spacing of its wheels. We realize that this engine will not run forever, or even as long as we hope the bridge will last, and that wheel loads are liable to increase, how much we cannot tell. So we assume that a possible load will be perhaps double the present. This is assumption No. 1. Then we know that when a train moves rapidly there is a certain—or, rather, uncertain—shock produced. How much this may amount to we do not know, but we will assume (No. 2) that it will be 50 percent. We then calculate the flange strain upon the foregoing assumptions, and are ready to determine what metal to employ. We intend to specify the use of soft steel, which will show, in test specimens, an elastic limit of 30,000 pounds per square inch, and an ultimate strength of between 54,000 and 62,000 pounds per square inch. We assume (No. 3) that if strained to 15,000 pounds per square inch, the metal would not deteriorate under repeated strains, but, to make absolutely sure, we assume (No. 4) as a safe-working strain one-half of this, or 7,500 pounds per square inch. Here we have made four tremendous assumptions, and have not mentioned others, such as, that the workmanship will be perfect, that the steel will not be damaged in handling or by heating, and that the bridge will not deteriorate from corrosion, though it is not doubt true that some of the assumptions balance others. Now, with so many factors entirely assumed, can we expect that our final result will be more than approximate, if, indeed, it is even that?

If this is true with steel structures, it is even more so with other materials, for no structural material is more uniform or better known than steel. In wood, we have many doubtful conditions which do not exist in metal, such as knots, shrinkage cracks, and rot, both wet and dry. In masonry, stone, brick, mortar and concrete there are uncertainties much more important that in steel. In fact, the longer an engineer's experience is in dealing with materials of construction, the more he feels the lack of an exact knowledge of what he is dealing with. In other branches of engineering besides ordinary construction, the case is similar. In dealing with foundations, in designing machinery, in hydraulic problems, in naval architecture, it will be found that the cases where you can obtain exact data, carry out your work by the use of exact methods, and obtain exact results, are extremely rare, if they can be found at all.

This being the case, should we not cultivate, in every possible way, the use of all methods of approximation which give results which are really approximate? A knowledege of exact methods is not to be despised. In fact, without knowing the exact method, one cannot be sure that any other is even approximately right, but the economy of labor and of time, which rough methods effect, will often enable an engineer to study a number of designs to see which is best, when, if he were obliged to work by exact methods, he would be forced to assume one plan and devote himself to that.

Many approximate methods are in general use at the present time, and they are being more widely adopted all the time, but there is still room for improvement in the same direction.

An example of this is the use of the slide rule. This instrument, which has been known for nearly 300 years, has, in the last 15 or 20 years, been increasing in popularity to a phenomenal extent. When the Thacher cylindrical slide rule, which will give results to five places, was introduced about 15 years ago, bridge engineers were at first slow to believe that the results would be accurate enough to supplant arithmetical or logarithmic calculations, but they soon learned that the accuracy was all that could be desired. Now the smaller slide rules, that give results to three places, have become almost universally adopted for this class of work. The graphical method of computing strains, which was at first used only as a check upon analytical methods, is now almost wholly relied upon in the case of irregularly shaped structures.

Another striking illustration in the change that is going on in engineering methods is in the style of drawings which are now in use, compared with those of earlier years. In former times it was considered the proper thing to make a drawing on egg-shell paper, which had to be dampened and pasted to the board, to tint all parts with extreme nicety, to vary the weight of the lines, and to carefully cross-hatch sections and shade all curved surfaces, if not to wash in shadows. Now the common drawing is made on tracing cloth, without shading, and often out of scale. It is even the practice in many offices to sketch in lines free-hand.

On the other hand, an instance of where approximate methods are very slow of adoption is in the case of loads for railroad bridges. Railroad engineers insist, in a large proportion of cases, on their bridges being figured for actual wheel loads, which are based upon the locomotives in use on their roads. They do this notwithstanding the facts that types of locomotives are constantly changing, and that the enormous steel cars that are now coming into use often give as great or greater strains than the locomotives. Anyone who has calculated bridges for these actual wheel loads can appreciate how much labor could be economized if the railroad engineers would only specify uniform loads, approximately equivalent to the wheel loads, and they could do this without making assumptions worth considering in comparison with others they are bound to make.

Above all, however, the advantage of methods of approximation is to encourage and foster in the engineer the faculty of taking a broad view of his problem. They help him to lose sight of the petty details of his design, and to look at the main features in proper perspective. This is of extreme importance.

It has often been remarked how many men have risen to eminence in the profession of engineering, who started without technical education, and it is not easy for one who is devoting a number of years to a study of the details of the science, to see how this is possible. In fact, technical graduates are sometimes a little prone to look down upon their employers when they find that they are unfamiliar with the integral calculus of the "method of least work." They may find, however, that the same employer, with still less work, can discover flaws in their armor. They will find that he can tell, at a glance, ap-

proximately the true answer to their problem, through his intuition of the proper proportions. In the examination of existing structures, one is constantly filled with wonder at the marvelous achievements of men who know nothing of how to calculate stresses. To be sure, we also find examples of construction so fearfully and wonderfully designed, that the wonder is, how they have stood at all, and undoubtedly many of the works of the uneducated men have disappeared from view on account of their unscientific construction; but the fact remains, that engineers have lived, and are now living, whose knowledge and skill has not been derived from books and teachers.

This is no evidence that education is not of immense advantage, but only that the minor niceties of methods are of secondary importance compared to the attribute of common sense, which with some is inborn, but with many only acquired with long experience.

How to cultivate this faculty in those who are not naturally blessed with it, is one of the problems which engineering schools must struggle with. It may not be practicable to introduce a course of "Common Sense," though, if it were, it would be interesting to know whether it would be considered "soft" or the opposite. Undoubtedly it is the aim of every instructor to inculcate the faculty to the extent of his ability in all he teaches; but one of the greatest aids in reaching this object would be to show wherein approximate methods may be safely adopted, and the adoption of them when possible.

GERMAN TESTIMONY ON THE METRIC SYSTEM.

The important discussion on the metric system and the proposed legislation at Washington, which was the feature of the last meeting of the American Society of Mechanical Engineers at New York, renders timely the following report on the experience of Germany with metric weights and measures. It is written by Dean B. Mason, vice consul-general at Berlin:

In view of proposed legislation to render the metric system obligatory for Government use in the United States, an effort has been made to ascertain from commission agents, importers, etc., in Germany how far the use of English weights and measures in the United States is considered a hindrance to the trade between the two countries; secondly, what results have been obtained by the introduction of the metric system in Germany, and the value of these results as bearing upon the question at issue in America. Considerable difference of opinion was found among the parties interrogated as to the extent of the hindrance caused by the use of different systems in the two countries.

An American commission agent residing at Berlin, who is constantly bringing American and German business men into connection with one another and who is quite intimately acquainted with the import and export trade between the two countries, considers that the use of the awkward system at present employed in the United States is a very decided inconvenience and hindrance to trade between the two countries. He cited various instances where injury had been caused, and among others the misfortune of an American who had his goods seized at the German custom house and was involved in a lawsuit with the government, owing to a blunder caused by the use of the two systems. A Hamburg commission agent and a German citizen stated that he was firmly convinced that the use of different weights and measures in the two countries caused inconveniences that made themselves seriously felt in every export and commission house dealing in American goods; that the conversion into decimal units caused serious loss of time; that the system of bookkeeping in use in Germany could not be applied to American goods. On the other hand, another Hamburg commission house dealing largely in American goods, which made inquiries among the different importing houses, stated that while the American weights and measures were considered extremely awkward and inconvenient, they were not looked upon as a serious obstacle to trade with the United States, as the firms accustomed to doing American business were used to them and employed tables for converting from one system to another.

Judging from the various sources of information at hand, it would seem likely that the use in America of the present system of weights and measures, while causing some inconvenience and increased clerical labor, does not seriously hamper the American export trade through the large German commission houses dealing regularly with the United States. With the firms buying only occasionally from America, the inconvenience of the two systems is felt more keenly. American firms unacquainted with exigencies of foreign trade and seeking to obtain connections or business abroad continue to send circulars in the English language, in which our weights and measures are used, the result being that they generally find their way to the waste-paper basket without serious consideration. A consular officer has not infrequent opportunity to observe difficulties created by ignorance of the metric system on the part of Americans, who are placed at a disadvantage owing to their ignorance on this subject. Particularly in the export of machinery, in which complicated specifications are often requisite, the difficulties caused by the use of the two systems are especially apparent.

Of greater importance than its bearing upon our foreign trade is the effect of the weights and measures employed upon the industrial life in the United States; but the whole subject of the advantages and disadvantages of the metric system has been so exhaustively treated in reports to the American government and easily attainable literature that the scope of this report is restricted as closely as possible to what lessons can be derived from German experience. On Aug. 17, 1868, the law was published which made the use of the metric system permissible after Jan. 1, 1870, and obligatory after Jan. 1, 1872. Whether the Congress of the United States can or ever will take such radical action is an open question, and the results of the adoption of the metric system by the American Government for itself can not be gauged by German experience; but in case it is eventually decided to render a system of weights and measures obligatory throughout the United States, the experience obtained here has a certain value. According to testimony obtained at the Berlin Chamber of Commerce and through other reliable sources of information, the general use of the metric system in wholesale business was introduced promptly without serious inconvenience or opposition, and with very satisfactory results. In retail trade some of the old weights and measures are still in use, after having been modified in order to correspond with the metric system, the old names being still retained. The German pound, for instance, is exactly one-half a kilogram, and many articles are sold at retail by the pound, half pound, etc.

Prof. Fischer, who was in charge of the German bureau of weights and measures at the time the metric system was adopted, and is probably better qualified to judge of the difficulties encountered in its introduction into Germany than anyone else, stated in a personal interview that no serious or concerted popular opposition to the innovation was encountered, and that, owing to the period of time after the law was published before the metric system became obligatory, the public was well supplied with metric weights and measures, and more or less familiar with their use. Prof. Fischer is fully convinced as to the great benefit derived by the German nation from the change. As to the expense involved by the change, it is impossible to derive any very definite conclusion from the statistics and reports of the German Government. Information was asked on this point both by the American and English Governments some time ago, together with data as to the difficulties and results of the introduction of the metric system into Germany, but a careful examination of the reports made by the German authorities failed to give any definite information on this point. Owing to the different economic conditions that prevailed in Germany thirty years ago, such information as could be obtained relative to the expense entailed by the introduction of the metric system would necessarily be of very limited value.

Whether the metric system could be introduced as promptly and easily in the United States as was done in Germany is

questionable, as Germany is a much smaller country, and the German people submit more readily to governmental interference and guidance. On the other hand, the American people are certainly less conservative and quicker to adopt new ideas than the Germans in 1872. Prior to the introduction of the metric system, the Zollpfund, which is equal to half a kilogram, had been introduced by the custom-houses, and was in general use throughout Germany, but the German currency of 1872 was not based on the decimal system, as is the case with the American currency. It is questionable whether the retention of the Pfund and some of the other old measures was of advantage. Prof. Carstens, who is an authority, and who published several books on the subject, protested against the retention of any of the old measures in a pamphlet which appeared in 1868, and his prediction that this half-way measure would be punished by delaying the complete adoption of the decimal system has been verified by subsequent events.

While German experience as to the difficulties incident to the introduction of the decimal system may be of limited value, there can be no question as to the great advantage derived from the change. On this point, public opinion is practically unanimous; whether it be the experts of the bureau of weights and measures, business men, or manufacturers, only one opinion has been found, and when the radical advantages of the metric system over the weights and measures formerly in use are considered, this unanimity is almost a matter of course. It is only those who have used the metric system after having been accustomed to the use of other weights and measures who can realize fully its great superiority when calculating or computing. The only example of the advantages of the decinal system for purposes of calculation over other systems that can be readily observed by the American public is the far greater ease and rapidity with which it is possible to calculate in dollars and cents than in pounds, shillings, and pence. While, owing to the great number of semi-independent States in Germany, the need of a single authorized system of weights and measures was still more imperative than in the United States, the advantages to be derived in America by the adoption of the metric system are practically the same as have already been attained in this country. Owing to its scientific character and greater simplicity, the German citizen has a far more complete comprehension of the weights and measures of his country than the American. He saves a great deal of time and labor both at school and in later life, and numerous possibilities of error are avoided. Considering the inherent advantages of the metric system and the experience of Germany and other countries where it has been introduced, it is safe to predict that if it ever comes into general use in the United States there will be the same unanimous verdict both as to its satisfactory character and the wisdom of its adoption that is given in Germany today.

The metric system has spread with ever-increasing rapidity throughout the civilized world. It has been adopted by the European states, with the exception of England and Russia, and by most of the South American states, by Mexico, and even by Turkey and Egypt. Unless the American people are willing to see the civilized nations using one universal system of weights and measures, and the United States and the more backward countries like China adhering to their old and clumsy weights and measures, it is likely the metric system will have to be adopted. Both in England and Russia the sentiment in favor of the metric system seems to be growing steadily, and it is likely that it may be adopted in these countries within the near future. It is probable that the agitation in favor of the adoption of the metric system in the United States will continue, and that if it is not introduced now, it may be introduced later on when the change would involve far greater expense and inconvenience. With the population increasing 20 percent. every ten years and a rapidly expanding industrial development, it is important that the metric system, if it be adopted at all, should be accepted as promptly as possible.

In considering the question of the adoption of the metric system in the United States, the one valid objection that can be raised is the difficulty of the change. Owing to different political and industrial conditions, the experience of European countries is of limited value to the United States; but their experience tends to show that the radical measure of rendering the metric system premissible for a certain period, after which it becomes the only system that is legal, is an effectual way of bringing it promptly into general use, and is far more economical and satisfactory than half-way measures. The experience of Germany also shows that an efficient bureau of weights and measures is one of the most potent and necessary factors in making such a change.

While the general introduction of the metric system into the United States will undoubtedly cause temporary expense and trouble, the benefits derived from its adoption will be permanent, and a far greater population than that of the United States at present will be materially benefited by the change.

Engineers' Society of Western Pennsylvania.

At the regular monthly meeting of the Engineers' Society of Western Pennsylvania, held at Pittsburg, Pa., on Tuesday evening, Jan. 20, Pittsburg's transportation problems were discussed. Antes Snyder, chief engineer of the Pennsylvania Railroad Co., presented a paper which covered the development of the railroad systems of the western section of Pennsylvania. The deepening of the Ohio river for the benefit of navigation at the expense of the National Government he said was unfair to the railroads for the reason that the public funds are drawn upon for the benefit of aiding the river transportation companies, while the railroads in order to improve their roads are compelled to expend millions of dollars of their own private funds. Capt. Rodgers, with an excellent paper, upheld the river transportation companies. He said that river shipments can be made in less time than rail for any distance over 500 miles, while the cost is less than half. The meeting was unusually well attended, 116 members and visitors being present. Sixty-three candidates for membership were elected, which is the largest number ever admitted to membrship at any one meeting. Owing to the varied lines of engineering work engaged in by the members of the association, it was decided to organize sections for mechanical engineering and designers and draughtsmen. It was also decided to publish, from time to time, bulletins containing lists of engineering positions vacant and of applicants for positions. All correspondence is to be confidential and will greatly aid manufacturers in this district to secure competent men. The annual banquet of the society will be held at the Hotel Schenley on Feb. 27.

The Sharon Foundry Co.

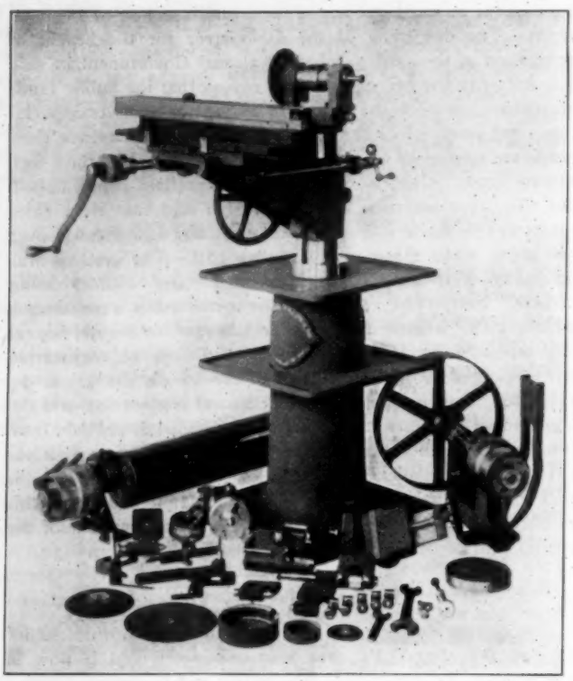
The pattern shop of the new plant of the Sharon Foundry Co., at Wheatland, Pa., has been completed and is now in operation. The structure is 80x120 feet and is equipped with a number of modern woodworking tools. The Riter-Conley Mfg. Co. has the structural work of the foundry well under way and it is probable that the foundry will be placed in operation about April 1. The foundry will be 450x120 feet. It will be commanded by two 20-ton cranes, the span being 60 feet. The craneway will extend out into the yard a considerable distance, thus permitting the removal of the heaviest casting from the foundry to the freight cars without any unnecessary handling. One of the lean-tos will be commanded by a 5-ton crane and the various departments of the foundry will be separated by sliding doors. The building has been laid out so that the cleaning department can be shut off from the molding floor, preventing the dust from coming into the latter department and sufficient room is provided to permit of the movement of the cranes from one department to another. Two cupolas, having a capacity of 20 tons an hour, will be installed, giving a daily capacity of about 125 tons. The foundry will operate on ingot molds and general gray iron castings. The ingot mold capacity will be about 100 tons daily, while 25 tons of gray iron castings will be turned out. Joseph Riddle, formerly connected with the Shenango Foundry & Machine Co., of Sharon, Pa., is president and superintendent, and Thomas Kennedy, secretary and treasurer. The company is capitalized at $250,000.

The Sandusky Foundry & Machine Co., Sandusky, O., has decided to install a blower system in its foundry and machine shop. The new equipment will be furnished by the Buffalo Forge Co.

UNIVERSAL CUTTER AND TOOL GRINDER.

This grinder, on which a patent has recently been allowed, is designed to grind any and all tools used in a machine shop, such as milling cutters, reamers, gauges, shafts, bushings and tools of all kinds. On a heavy column is secured a spindle head which carries the emery wheel. This head can be turned in its seat to a right angle each way, thereby bringing the emery wheel in any position from a right angle to parallel with the table; the head is graduated by degrees and can be fastened in any position. The machine is compactly arranged and the workman stands in the same place for all the different work he has to grind, with the light always to the best advantage. The table is moved by means of a clutch handle, and the handle may be quickly put in the most advantageous position for the operator.

The adjusting table has graduations on the end. The lines indicate 1-32 per one foot of table, and taper work can be set by it; it is also provided with adjusting screws. Adjustable table stops are furnished and should always be used to save



THE OESTERLEIN MACHINE CO'S NEW CUTTER AND TOOL GRINDER

thereby the wheels and the work. The table is raised by means of rack and pinion and will remain in any position; the rack is held in position with one screw, which screw may be removed and the table swung around the column, as in other grinders. The cross slide screw has graduations to read to thousandths. The spindle is of tool steel, hardened and ground, runs in bronze boxes and can be adjusted to compensate for wear. All slides are scraped to a fit. The table lowers 5 inches, has cross movement of 6 inches and moves back and forth 15 inches. The center swings 7½ inches diameter and takes 16 inches on the adjustable table and 14 inches on the regular table. Weight of machine about 600 lbs.

The complete universal cutter and tool grinder is furnished with adjustable table, universal head with grooved pulley and center, bushing with screws and collars for universal head, swivel vise, gear cutter attachment, drop center, 3 inch chuck, internal grinding attachment, full set of emery wheels and wrenches and countershaft for spindle and drum overhead works. The machine is manufactured by the Oesterlein Machine Co., of Cincinnati.

An officer of the American Car & Foundry Co. states that with the recent orders placed by the Illinois Central Railway Co., the company is sold up to next August. He adds that beyond that date car building will depend very largely on the outlook for crops.

SUGGESTED AT THE SHOP.

BY F. O. REMAN.

The use of a tool is but the lengthening of an arm or an improvement on the hand and a machine in all its complications may be traced back to the same source and pattern—an extension of handicraft. For this reason every machine has an attraction to the intelligent eye that sees something more than masses of metal grinding out a product in imitation of hand work. Whether this be textile fabric or anything else is really not important. All men, however, do not look at this matter from the same point of view. The regularity of the printing press product is an eyesore to the man who sees in the finely illuminated missal of monkish days a treasure more in accord with his ideals of the eternal fitness of things. Creation is to him the main hope, imitation something to be avoided as a curse.

* * * * *

Unfortunately for those who hold this view—and there are not a few of this cult—machine made products are so numerously varied that contact is unavoidable. The printing press and the linotype, the telephone and the typewriter, methods of transportation and the like are the products of the mere machine and few escape from intercourse. Is the evil of it really so great after all? I trow not. I have been reading of the joys of art and the happiness of doing hard work, of the love that radiates from handicraft, of the misguided imitator who repeats mechanically, and the simon-pure artist who never makes two things alike. There's any amount of poor work in either class but that is another story. The theory implies a sort of belief that true happiness consists in possessing a few things rather than having many and being possessed by them. This sort of thing is the ache for that which will last, the chair that never breaks down and the desk that permanently endures. In some respects the aim is good but the range is too great. Simplicity and good taste, a finely cultivated sense of proportion, skill in the production of pleasing results are just as desirable in the machine and machine work as ever.

* * * * *

The fact is right here: machine work is hand work. Whatever joy is to be had from the one may spring from the other. The machine made product is more nearly uniform in type but the standard is always set high, as lofty as the best made by hand. Nor is the best machine altogether independent of hand work. The drawing of an even line and then the carving of a smooth surface preceded the planer, just as surely as the final touch is by hand given to the best product of that tool. Carefully as the surface plate is brought to a finish on the machine, the more cautiously is the accurate adjustment made with the standard by hand treatment. In the machine shop as elsewhere machinery is doing the drudgery of art.

* * * * *

So has the work progressed down the line till now. How the lathe has grown from the primitive bow string and the cleft sticks supporting the work is not so clear as the certainty with which hand labor has marked every stage of the improvement. The growth has been creative at each step and the last workman has had the benefit of the accumulated learning and skill of those who have gone before on the same path. The standard is always an ideal approached by compromise. The former supplies the target which strictly speaking is unattainable and the latter indicates the usual result. The compromise is inevitable in machine products or anything else and shows the border line of practical attainment. The planer is limited in accuracy by the yielding floor, the bent bed, the strained table, the infirm apron, the keenness and solidity or otherwise of the cutting and supporting conditions. The cooling stresses either in machine or product, abated or increased by a minute adjustment of the work; the removal of a thin restraining skin of harder metal, etc., are all to be met and humored by the artist in control. Or take the lathe for example; the turning of a cylinder, just a plain straight shaft—a shaft in which any point on the circumference is exactly the same distance from the axis of the piece—is not nearly so easy a thing to do as it may seem. Not by any

means the facile operation that the machine critic may imagine.

* * * * *

Art is just as desirable as ever in the sense of a skillful arrangement of means to produce a definite end nor is this devoid of the play of imagination even in practical work. Design has scarcely reached the stage where it can calculate a certain strain per square inch into every structure and then multiply the result by a very liberal factor of safety to cover any demand that the future may bring forth. Behind the designer is the coercion of a company of investors who look askance at the unnecessary outlay for metal or anything else and the product is scaled down accordingly. In front of the designing engineer are the competitor and his quotations, his own reputation for that accuracy which avoids a clumsily strong or weak construction, and the equally individual factor of shop capacity. And this last item may be a most variable asset, a thing limited by supplies of metal, fuel, coke and sand, labor and machine equipment, costkeeping and other accounting aids to force and follow production. Delay in the drafting room or pattern shop, an argument with the union or any number of things may cause friction; then the productive machinery drags and the wary forethought and skill may go for naught The successful handling of these forces by the men at the head of affairs has always seemed to me the practice of a true art in every sense of the word—a pursuit in which there is sufficient uncertainty to quicken alike the store of manufacturing experience and the gambling instinct. A machine examined from this point of view is thus seen to have something of the broader meaning of art.

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I have known this for a long time and I dare say few mechanics are ignorant of the matter, but it is all in the point of view. Now that I have done the job up in my own peculiar way I can invite a welcome for an article which appears in a recent issue of the *Journal of Political Economy*, Chicago, which bears down good and hard on the file. I regret exceedingly that I cannot give the author's name and I have made but an all too brief selection from the pearls of thought he has so lavishly thrown into print. Nevertheless I shall quote enough to show convincingly what a wide swath can be cut in this field, and the reader can adjust his artistic taste accordingly. I see no way to dispute the argument which follows. Perhaps it might have been improved by the application of the sand blast instead of leaving it just as it struck hot from the ladle, but this is a matter of choice.

* * * * *

"Such work as goes on today without being immediately under the guidance of the mechanical technology, is, with sporadic exceptions, subsidiary to that main body of work which this technology directly and unquestioningly controls. And the precarious margin of work still left outside the sweep of a rigorously consistent machine technology grows visibly narrower from day to day. Therefore any movement for the reform of industrial art or for the inculcation of aesthetic ideals must fall into line with the technological exigencies of the machine process, unless it choose to hang as an anaemic fad upon the fringe of modern industry. The machine process has come, not so much to stay merely, but to go forward and root out of the workmen's scheme of thought whatever elements are alien to its own technological requirements and discipline. It ubiquitiously and unremittingly disciplines the workman into its own way of doing things, and therefore into its way of apprehending and appreciating things. 'Industrial art,' therefore, which does not work through and in the spirit of the machine technology is, at the best, an exotic. It will not grow into a dandelion-like 'weed of cultivation,' for it has had no chance of life beyond the hothouse shelter of decadent aestheticism. At its inception the movement (initiated by the Dreamer) was a romanticism, with a smear of lackadaisical aestheticism across its face. But that was not its whole meaning, nor is it the more enduring trait. Archaism and sophistication came of a revulsion against the besetting ugliness of what was before the eyes of the leaders. The absolute dearth of beauty in the philistine present forced them to hark back to the past. The enduring characteristic is rather an insistence on sensuous beauty of line and color and on visible serviceability in all objects which it touches. And these results can be attained in fuller measure through the technological expedients of which the machine process disposes than by any means within the reach of the industry of a past age."

Meeting of Steel Corporation Officials.

The United States Steel Corporation has issued a statement concerning the recent meetings of the presidents of the subsidiary companies which were held at New York, and attended also by members of the executive and finance committees. The statement says:

"Various important questions have been fully discussed, carefully considered and recommendations embodying the conclusions of the presidents will be submitted to the executive committee and finance committee respectively of the United States Steel Corporation for consideration and recommendation. Among other subjects considered are proposed improvements and extensions to the manufacturing, mining and transportation properties of the various companies and recommendations for the expenditure of considerable sums have been made. Many of the improvements suggested, however, were rejected after full discussion and consideration. The improvements which will be made are in the direction of increasing production and facilities for manufacturing, but more especially to reduce the cost of production and distribution.

"There were also included in the discussions and recommendations the Union and Sharon steel properties, lately acquired, the management of which will be so divided and distributed as to give control of the same to other subsidiary companies interested in the same line of business. The presidents also considered somewhat in detail the work laid out by the different corporations for the year 1903, with the object of so systematizing and harmonizing the business interests of the different companies as to produce the best results.

"The question of transportation by outside railroad companies, particularly in the coal and coke districts, received much consideration and recommendations were made which, if adopted, it is believed will be highly beneficial. The feeling of harmony which exists between the officers of the subsidiary companies and between them and the officers and men of the committees of the United States Steel Corporation is noticeable and agreeable."

British and American Iron Prices.

The Cleveland district, in common with several others, has benefited materially by the large demands made by the United States for foreign pig iron during 1902. The total quantity exported thither from Middlesbrough in that year was 190,744 tons, against only 3,500 tons in the previous year. In the five previous years, the exports thither were *nil*. This new development is one that is likely enough to continue so long as prices remain high in the United States. The average price of pig iron in that country in 1902 may be taken at about $23, or approximately £4 15s per ton. This compares with 44s to 53s per ton for Cleveland iron. The American prices have therefore been nearly 100 percent higher than those of Cleveland, and hence the real explanation of our shipments to the United States in 1902. Those shipments, unfortunately for this country, have not embraced any material quantity of finished iron or steel. The total shipments of these products from Middlesbrough in 1902 were 7,227 tons, but small as this quantity is, it is larger than those of any preceding year since 1890.—[London Iron and Coal Trades Review.

The Eastern Ohio Traction Co. has prepared plans which call for the ultimate expenditure of an amount approximating $500,000. Considerable part of this will be expended for new power. The Chagrin Falls line will be extended to Warren, a double track will be laid from Cleveland to Gates Mills, and a number of new cars will be put in service.

The Chicago & Alton Railroad has made contracts for 50 engines to take care of its St. Louis Exposition traffic.

27,571,121 Tons of Lake Superior Ore in 1902.

With somewhat more than usual difficulty, owing to the large number of mines producing last year, 21 of them appearing as shippers for the first time, our statistics of the Lake Superior iron ore shipments for 1902 have been collected from official sources. These returns have been incorporated in our annual iron ore sheet which accompanies this issue as a supplement. The figures show that the total shipments by water and by all-rail routes in 1902 were 27,571,121 gross tons. This does not include the shipments from the Helen mine on the Canadian side—208,420 tons—of which 205,498 tons was sent to Lake Erie ports. It thus appears that 27,776,619 tons of Lake Superior ore was shipped last year for smelting in the blast furnaces of the United States.

It is interesting to note that 133 mines on the five Lake Superior ranges shipped ore last year, as against 104 in 1901. The distribution is as follows: Marquette 19, Menominee 34, Gogebic 27, Vermillion 5, Mesabi 48. The great gain was on the Mesabi range, where 17 new shippers appear. It should be said that more than 133 mines shipped ore last year, since our statistics report the Cleveland-Cliffs Iron Co.'s properties on the Marquette ranges as though they were one. The Lake Superior group on the Mesabi range might properly count as three—the Hull, Burt and Rust. There are other similar cases.

The shipments from United States Steel Corporation properties in 1902 were 16,136,787 tons, or 58.5 percent of the whole. This is apart from one half the 530,291 tons from the Pewabic mine, in which property the Carnegie Steel Co. has a one half interest. It also leaves out the 28,106 tons from the Iron Ridge mine in Wisconsin, belonging to the Illinois Steel Co. This mine is remote from the Lake Superior ranges and has never been included in our statistics.

The output of the Cleveland-Cliffs Iron Co., as given under the Marquette range above, does not represent all the ore produced, and much less does it represent the ore marketed by that company. On the same range it had the Volunteer last year, and on the Gogebic range, the Ashland. In addition it has one quarter of the output of the Lake Superior and the Queen Group. Thus its total shipments for the year become 1,776,728 tons.

MARQUETTE RANGE.

MINE.	GROSS TONS.	MINE.	GROSS TONS.
Bessie	5,007	Lake Superior	832,796
Beaufort	59,781	Lillie	79,919
Cambria	63,976	Negaunee	204,286
Champion	205,721	Princeton	118,048
Chester	24,874	Queen Group	418,044
Cleveland-Cliffs	1,104,864	Republic	157,646
East New York	38,761	Richmond	50,041
Hartford	7,440	Volunteer	32,736
Jackson	15,449	Winthrop	129,496
Lake Angeline	304,125		
Total			3,853,010

MENOMINEE RANGE.

Antoine	110,993	Hiawatha	74,596
Aragon	646,203	Hope	3,373
Armenia	100,864	Lamont	47,267
Baltic	64,664	Lincoln	7,747
Bristol	129,035	Loretto	128,300
Chapin	956,812	Mansfield	31,181
Columbia	186,798	Michigan	53,272
Commonwealth	112,704	Millie	25,935
Crystal Falls	195,555	Northwestern	1,324
Cundy	183,052	Paint River	10,383
Dunn	2,816	Penn Iron M'g Co.	273,443
Ethel (Hennepin)	14,455	Pewabic	530,291
Florence	130,798	Quinnesec	62,531
Foxdale	15,015	Riverton	215,850
Great Western	42,470	Tobin	55,238
Groveland	7,599	Verona	43,245
Hemlock	123,331	Vivian	40,384
Total			4,627,524

GOGEBIC RANGE.

Ada	8,555	Meteor	19,117
Anvil	135,502	Mikado	98,834
Ashland	301,824	Montreal	136,354
Atlantic	190,213	New Davis	31,530
Aurora	402,981	Newport	141,571
Brotherton	53,255	Norrie	1,080,032
Cary	136,895	Ottawa	26,141
Colby	22,526	Palms	32,113
Chicago	44,625	Pike	6,343
Harmony (Germa)	205,502	Sunday Lake	144,630
Hennepin	36,383	Tilden	468,672
Iron Belt	79,121	Upson	11,065
Ironton	8,555	Yale (West Colby)	26,043
Jack Pot	102		
Total			3,663,484

VERMILLION RANGE.

Chandler	645,786	Savoy and Sibley	322,241
Minnesota	275,168	Zenith	167,205
Pioneer	673,863		
Total			2,084,263

MESABI RANGE.

Adams	1,242,923	Laura	16,453
Aetna	196,316	Leetonia	28,784
Agnew	45,582	Lincoln	87,908
Auburn	38,283	Longyear	22,788
Biwabik	623,127	Mahoning	1,038,645
Chisholm	200,629	Malta	222,640
Clark	350,799	Minorca	35,499
Commodore	65,833	Morrow	35,571
Corsica	59,292	Mountain Iron	1,421,456
Croxton	18,594	Oliver	5,131
Day	106,516	Pearce	54,884
Duluth	150,220	Penobscot	209,531
Elba	207,454	Pettit	17,278
Fayal	1,919,172	Pillsbury	238,122
Franklin	111,085	Roberts	28,972
Genoa	399,719	Sauntry	249,837
Glen	23,875	Sellers	193,428
Grant	51,946	Sharon	224,526
Hale	54,289	Sparta	227,444
Hawkins	5,892	Spruce	543,203
Jordan	147,931	Stevenson	1,434,681
Kanawha	24,829	Union	103,522
Lake Sup. Group	766,311	Utica	9,009
La Belle	70,753	Wills	12,158
Total			13,342,840

Grand total.....27,571,121 tons

In the following tables the shipments are given by ranges and by ports and all-rail:

SHIPMENTS BY RANGES.

	1902. Gross Tons.	1901. Gross Tons.	1900. Gross Tons.	1899. Gross Tons.
Marquette Range	3,853,010	3,254,620	3,157,522	3,757,010
Menominee Range	4,627,524	3,605,449	3,201,221	3,301,052
Gogebic Range	3,663,484	2,938,155	2,875,295	2,795,856
Vermillion Range	2,084,263	1,786,063	1,655,420	1,771,502
Mesabi Range	13,342,840	9,001,890	7,809,535	6,620,384
Total	27,571,121	20,589,237	19,059,393	18,251,804

SHIPMENTS BY PORTS AND ALL-RAIL.

	1902. Gross Tons.	1901. Gross Tons.	1900. Gross Tons.	1899. Gross Tons.
Escanaba	5,413,704	4,022,668	3,436,734	3,720,218
Marquette	3,595,010	3,354,284	2,661,861	2,733,596
Ashland	3,553,919	2,886,252	2,633,687	2,703,447
Two Harbors	5,605,185	5,018,197	4,007,294	3,973,733
Gladstone	92,375	117,089	418,554	381,457
Superior	4,180,568	2,331,077	1,522,899	878,942
Duluth	5,598,408	3,437 955	3,888,986	3,509,965
All-Rail	531,952	431,715	489 078	350,446
Total	27,571 121	20,589,237	19,059,393	18,251,804

By reference to our iron ore supplement it will be seen that the total shipments from the Lake Superior region have now reached the stupendous total of 219,583,642 tons. Of this amount there was shipped 146,142,995 in the past 10 years, or almost exactly two thirds. In other words in the 10 years beginning with 1893 the shipments of iron ore from Lake Superior have been twice as much as was shipped in 37 years preceeding 1893. This is an impressive statement. It is noteworthy that the giant Mesabi, though the infant among the ranges, is now in second place, with shipments of 53,747,807 tons in its 10 years. By another year it will have quite outstripped the veteran Marquette with its history of 47 years.

On Wednesday, Jan. 21, the 10-inch continuous mill of the Brown-Bonnell plant of the Republic Iron & Steel Co. produced 506,000 pounds of material, which breaks all records. The 8-inch mill at this plant on the previous day produced 80,000 pounds of half rounds.

WEBER GASOLINE MINE LOCOMOTIVE.

The accompanying illustration shows a locomotive for mine and industrial purposes recently designed and built by the Weber Gas & Gasoline Engine Co., of Kansas City, Mo. For outside work it is provided usually with a cab. For mine work no cab is needed, but a scrubber is supplied for neutralizing the products of combustion. The engine shown has a scrubber carried on the rear end of the frame. On the front end are the gasoline tank and seat for the driver. The engine is in the center directly over the four wheels which carry the locomotive. The flywheels for the engine are heavy disks, one on each end of the shaft. The frame is of steel. All holes are drilled and reamed, and the parts are held together by turned drift-bolts. The axle boxes are provided with vertical spaces to allow the introduction of cushion springs to prevent jar. The driving wheels are pressed on the axle and keyed; they have steel tires shrunk on.

The engines are of the double opposed cylinder type, which handles the load with minimum vibration. Power is transmitted from the engine shaft to the driving axle by steel cut gearing. The different motions—forward, backward and stop—are controlled by steel clutches operated by levers. All levers and valves for controlling the engine are within easy reach of the operator's seat. The engineer is enabled by a special improvement to cut out either cylinder from work. This reduces the consumption of gasoline when the engine is running light, switching or coupling cars. The seat is so placed that the view of the engine-driver is not obstructed from the track ahead. The locomotive is provided with a powerful brake, and in case of an emergency both the brake and the reverse can be used.

On the drive wheel shaft of the locomotive two friction clutches are employed—one for forward and one for reverse motion. These engage and disengage in steel spur wheels which are loose on the shaft and driven by two spur pinions on the engine shaft. For the forward motion the clutch is thrown in on one gear, and for the backward motion the clutch is thrown on the outer gear. While the clutch is driving one spur gear the opposite spur gear would be running loose on the shaft, and when the clutch is in its intermediate position neither gear would operate, and the drive wheel shaft is free to rotate in the center of the spur gears. The gearing only produces one speed forward and one speed backward, and speeding of the locomotive is effected by the engine, which is controlled by the engineer from his seat.

The cooling water for the cylinders is circulated through the water jackets of the engines and returned to the tank by means of a small rotary pump driven from the balance wheel rim by frictional contact.

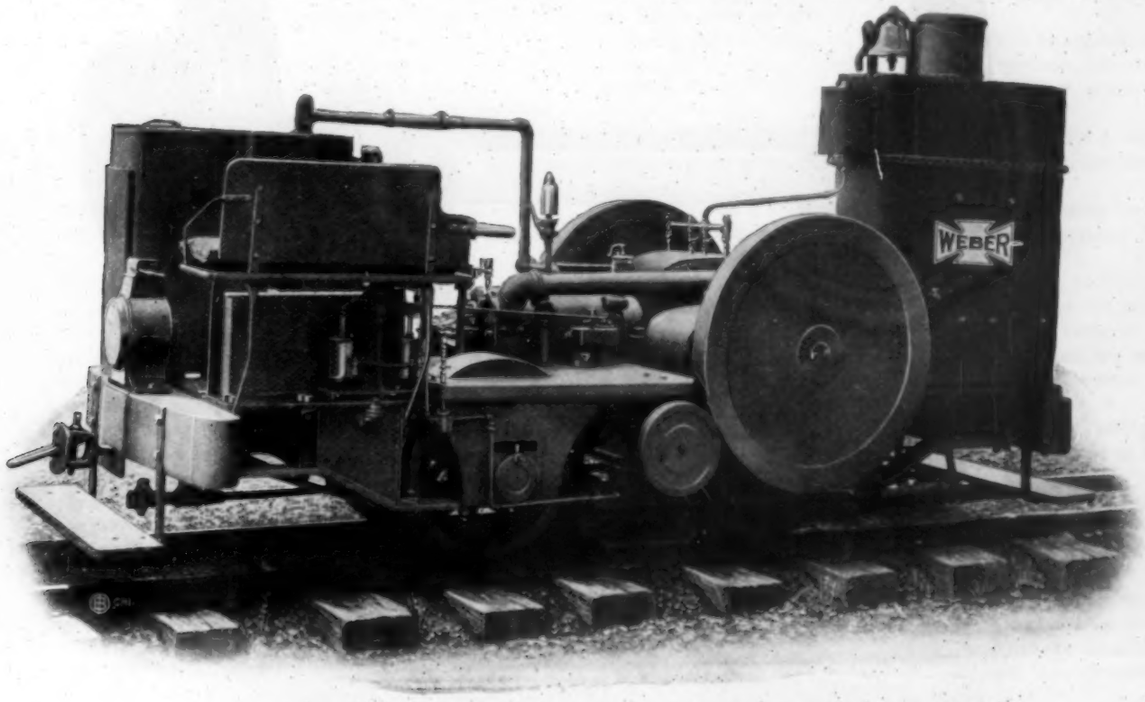
The two small cylinders shown below the engineer's seat are attached to an air pump which is used in starting the engines. The locomotive is provided with rail brakes on either side in such a way that the weight of the locomotive is thrown on these brakes. The system of supplying gasoline to the cylinders is simple and positive, and is almost automatic in its action, requiring little attention.

The scrubber has proved effective in neutralizing the products of combustion. It consists of an iron tank partly filled with water and coke. The products of combustion enter this scrubber at the bottom and while passing through are neutralized in such a way as to render them harmless to operatives in a mine. The water in the scrubber must be replenished from time to time as it evaporates.

In the design, care has been taken to house the working parts, the gearing and clutches, and to protect them from grit and dust. This is necessary to save lubricating oil, decrease the power required and prevent cutting of bearings, etc.

The makers claim for this type of engine low first cost, small cost of operation, low cost of repairs, safety from fire and electric sparks, handiness and quickness in handling loads. The locomotive can be built of different dimensions to suit gauge of track, grades, curves, load to be hauled; and for mine work, as to height and width of gangway.

It is claimed that the 25-h. p., 4-ton size, has a tractive force, as shown by tests, which on a level track, will pull 258 tons.



THE WEBER GASOLINE MINE LOCOMOTIVE WITH SCRUBBER.

The Ohio Brass Co. has decided to substitute alternating-current power distribution for the direct-current system at present in use in its shops at Mansfield, O. A recent purchase from the Westinghouse Electric & Mfg. Co. comprises a 180-kilowatt, 7,200-alternation, two-phase alternator, a direct-current exciter, switchboard equipment and the following induction motors: Two of 40 h. p., four of 30 h. p., one of 20 h. p., one of 15 h. p., and one of 2 h. p. This apparatus is to provide increased capacity.

The St. Mary's Machine Co., St. Mary's, O., will move its plant to Muncie, Ind. A representative of the company states that new machinery will be bought immediately, and that the plant will be in operation in June.

MULTIPLE PUNCHING MACHINE.

One of the latest type of multiple punching machines built by the Williams, White & Co., of Moline, Ill., is illustrated in the halftone. This particular machine is about 7 feet long and very rigidly and solidly designed. The main frame is a single casting of about 28,000 pounds weight. The firm makes these machines in different lengths and has quite a variety of other sizes. This size is perhaps more popular than any other because it covers quite a range of work with large capacity. The company builds heavier, longer, and also lighter machines, however.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market and Some of their Wants:—

Kilbourne Mfg. Co., of Troy, N. Y., has been incorporated to manufacture wire goods; capital, $50,000. Directors: James H. Caldwell, C. F. Kilbourne, W. H. Shields, C. H. Parks, of Troy, and H. H. Shields, of Bennington, Vt.

A new enterprise, known as the Beall Non-Pounding Frog & Crossing Co., is being organized in South Bend, Ind., for the purpose of promoting Allen M. Beall's invention, a smooth rail, non-pounding crossing.

The London Engine Supplies Co., Ltd., London, Ont., has been incorporated with a capital of $40,000.

The Thompson Mfg. Co., Ltd., St. John, N. B., has been incorporated with a capital of $40,000 to carry on a general foundry and machine business.

The Bond Steel Post Co., Adrian, Mich., has increased its capital stock from $40,000 to $100,000.

The Lefferts Galvanizing Works, Owego, N. Y., have been incorporated with a capital of $75,000.

The Union Steel Screen Co. has been incorporated at Battle Creek, Mich., with a capital of $200,000.

The Burger Iron & Wire Works Co., Akron, O., will increase its capital stock from $10,000 to $25,000, in order to make improvements next spring.

The Enterprise Enameling Works, Wheeling, W. Va., have increased their capital stock from $50,000 to $100,000, and will use the new capital in making improvements.

The American Oar Co., capital $10,000, has been incorporated at Detroit, Mich., to manufacture a steel bladed oar.

The Wasatch Anchor Fence Co., capital $100,000, has been incorporated at Salt Lake City, Utah.

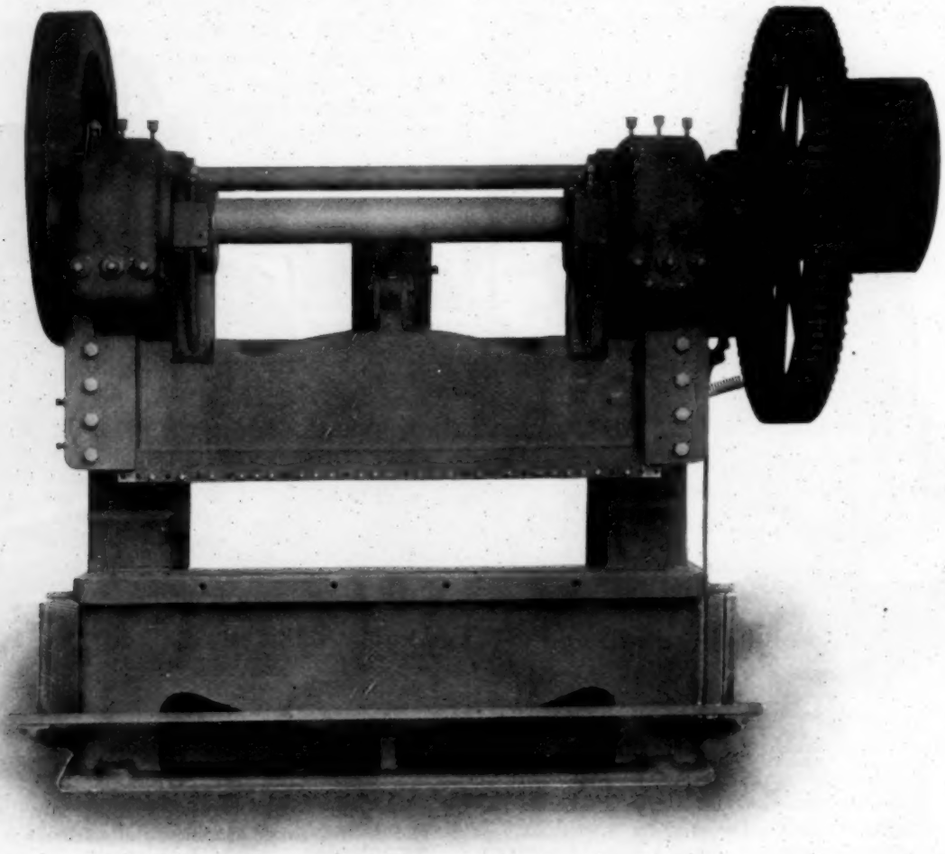
The F. D. Stowe Co., of Wilmington, Del., has been incorporated with a capital of $50,000 to manufacture engines.

The National Brass Mfg. Co., Rochester, N. Y., has been incorporated with a capital of $5,000 to manufacture and sell brass, steel and iron implements.

The Delaware River Steel Casting Co., Philadelphia, has been incorporated with a capital stock of $500,000.

The Manhattan Pattern Works, New York City, have been incorporated with a capital of $25,000.

The Sapulpa Blacksmith & Machine Shops, Sapulpa, Ind. Ter., have been incorporated with a capital of $5,000.



MULTIPLE PUNCHING MACHINE.

The Conneaut Can Co., Conneaut, O., has decided to purchase machinery to increase the output 50 percent. It will not be necessary to erect a new building.

The Grant Wire Fence Co., recently incorporated under the laws of New Jersey, with a capital of $50,000, will build a plant at Ashtabula, Ohio. The main office will be in the Wilshire Bldg., Cleveland.

The J. L. Perkins Co., Chicago, has been incorporated with a capital of $200,000 to manufacture tin plate, sheet metal and cornice work.

The Aetna Retort Co., Chicago, has been incorporated with a capital of $30,000 to manufacture machinery, steam fittings and boiler appliances. The incorporators are Geo. W. Hotaling, William A. Ingalls and Thomas H. Fitzgerald.

The Star Ball Bearing Axle Co., Princeton, Ill., has been incorporated with a capital of $15,000.

The Galena Iron Works Co., Galena, Ill., has been incor-

porated with a capital of $2,000 to operate a foundry and machine shop.

The American Foundry Fencing Co., of New York City, has been incorporated with a capital of $25,000.

The Ralph B. Carter Co., of New York City, has been incorporated with a capital of $25,000 to manufacture machinery.

The Kilgore Machine Co., of Minneapolis, Minn., has been incorporated with a capital of $100,000.

The Fogg Mfg. Co., New York City, has been incorporated with a capital of $100,000 to deal in machinery appliances.

The Warren Ball Bearing Fixture Co. has been incorporated with a capital of $30,000.

The John Inglis Co., Ltd., Toronto, Can., has been organized with a capital of $250,000 to take over the foundry and machine business formerly conducted by William Inglis, under the firm name of John Inglis & Sons.

The Taylor-Martin Engineering Co., Newark, N. J., has been incorporated with a capital of $24,000 to do general engineering and contracting business. The incornorators are Percy B. Taylor, Luther D. Marsh and Herbert B. Taylor, all of Newark.

United States Shaking Grate Co. has been organized at Augusta, Maine, to manufacture shaking grates. Capital stock, $300,000. Officers: President, F. L. Dutton; treasurer, G. M. Webber, both of Augusta, Me.

The George D. Mays Machine Co., Concord, N. H., has been incorporated with a capital of $60,000.

The Standard Car & Foundry Co., Harrisburg, Pa., has been incorporated with a capital of $20,000.

The Summerfield Machine & Mfg. Co., Harrisburg, Pa., has been incorporated. Capital, $100,000. The directors are Rudolph G. Summerfield, Howard S. Evans, T. Raymond Evans, and Thomas Evans, of Pittsburg, and John S. Lucock, of Bellevue.

The Central Electric & Mfg. Co., of Youngstown, O., has been incorporated with $20,000 capital for the purpose of engaging in the manufacture of electrical supplies. The incorporators are: W. S. Goodhart, E. F. Foreman, L. C. Glass, Emil I. Anderson and C. H. Denison.

The Ironton Engine Co. has been organized at Indianapolis, Ind. The company has started to erect an 87x327 feet structure at Ironton, O., and will begin operations in the plant on or before May 1, 1903. The business of the Alfree Engine Co., of Indianapolis, will be taken over and the company will build what is known as the Alfree engine, the Alfree Engine Co. going out of existence. The officers of the new concern given below are practically the same as those that were identified with the old one: J. B. Alfree, president; H. A. Marting, vice president; D. H. Palmer, secretary; A. H. Mittendorff, treasurer.

The King Drill Mfg. Co., Nebraska City, Neb., have just finished the building of a new foundry. Storage and pattern buildings are separate from the main structure.

The Newcastle Bridge Co., of Indianapolis, Ind., closed a contract last week with the Midland Portland Cement Co. for the structural steel work of the latter's new plant to be erected at Bedford, Ind., which will require 600 tons, at a cost of $46,000.

Fires and Accidents:—

The nail mill of Peck, Benny & Co., Montreal, was burned last week; loss, $25,000.

The fire which recently damaged the property of the Simonds Mfg. Co., Chicago, was only in the city salesroom and did not affect the business of the company seriously.

One of the walls of the Western Furnace & Foundry Co., Omaha, Neb., caved in recently, destroying the foundation of the building and also that of an adjoining structure. Three walls are still standing, but it is doubtful if they can be used.

New Construction:

The Board of Trade, of Newark, O., has complied with the conditions necessary to secure the building of large additions by the Wehrle Stove Co. and the Thomas plant of the American Ingot Mold Co. The main foundry building will be 1000 by 140 feet. The new buildings and equipment of both foundry and Thomas plant will cost about $250,000. Material has been ordered and the work of construction will go forward at once. Mr. Wehrle says that the new foundry will be in operation by July 1, 1903.

The Perry Side Bearing Co., Chicago, will build a factory of brick at Joliet, 60 feet wide by 160 feet long, fifty feet of one end two stories, warehouse for raw material on one end, and one for finished products on the other, with shop in the center. The company expects to use electric power from the water power plant at Joliet.

The Superior Foundry Co., Cleveland, will build an addition at a cost of $1,600.

The Madison Foundry Co., Cleveland, will build an addition at a cost of $3,000. The company has increased its capital from $20,000 to $35,000.

The Osborn Engineering Co., Cleveland, has prepared the plans for the cement works to be built at Struthers, O., by the Struthers Furnace Co.

General Superintendent Walter A. Post, of the Newport News Shipbuilding & Dry Dock Co., Newport News, Va., has confirmed the rumor that the company is considering the feasibility of erecting a plant that will turn out all of the steel castings used in ship construction.

The Rumsey Improved Gas Engine Co., Ripley, N. Y., has purchased a site and will soon build a plant.

The Hitchcock Supply Co., Springfield, Mass., has purchased a site and will erect a machine shop. The estimates have not yet been made, but it is expected that work will be begun in the early spring.

Joseph F. Rothe, Queen Bay, Wis., expects to build a large foundry at an early date. It is to take the place of the plant now operated by him, and will be much larger.

The Rensselaer Chain Co., Troy, N. Y., has recently made important additions to its plant, and largely increased the force of chain makers.

The new plant of the Baltimore Rolling Mill Co., at Canton, near Baltimore, is now partially in operation. The full force will not be employed until March 1, by which time it is thought the finishing mills will be completed. About 100 men are now at work; later on the number will be increased to 400.

The Wright & Colton Wire Co., Worcester, Mass., will establish a department for the manufacture of wire rope at its plant at Palmer, Mass.

The two story $50,000 addition to the plant of the Aurora Automatic Machinery Co., Aurora, Ill., has just been completed. When all the machinery has been installed about 100 men will be employed.

The Solid Steel Castings Co., Chester, Pa., has purchased a site 80x95 feet, on which is a building which has been used as a convent. At present the company will use the structure for offices, but it is expected that a building for manufacturing purposes will be erected at some future time.

A new two story building is to be erected by the Architectural Iron & Wire Works, Wheeling, W. Va. Several additions will be added later.

The St. Louis Steam Forge & Iron Works, East St. Louis, Ill., are preparing plans for a new steel plant which will cost about $600,000. There will be three open hearth steel furnaces of from 30 to 40 ton capacity each, blooming mill, soaking pits, strippers, etc., all to be covered by a building of steel frame construction. A new power house is also to be built. The new plant will have a daily output of from 150 to 200 steel billets. The product will be used in the forge department and guide mill of the plant.

It is reported that the Southern Railway will soon begin extensive improvements to its shops at Spencer, N. C. The report states that at least $300,000 will be expended in enlarging the buildings and in installing new machinery.

The Filer & Stowell Co., Milwaukee, Wis., will shortly build a 15-ton furnace for steel castings at a cost of $50,000.

The new building of the Gulfport Foundry & Machine Works, Jackson, Miss., has been completed and the machinery is being put in place.

F. A. Grier & Son, Salisbury, Md., have completed their machine shop, 30x70 feet, 2½ stories, and the machinery has been installed. In the rear of this building a foundry is being erected 30x30 feet, two stories.

The Pettibone-Mulliken Co., Chicago, has purchased 30

acres at Austin, a suburb of Chicago, and will put up two large buildings, one 700x180 feet, and the other 280x200 feet, for the manufacture of steam railway frogs and switches.

It is reported that the Northern Pacific Railroad contemplates the erection of a foundry in connection with its shops at Livingston, Mont., to cost $50,000. The large machine shops, completed last summer at a cost of $200,000, give employment to several hundred men.

The Hoefer Mfg. Co., Freeport, Ill., has purchased a site and will erect a new plant for its own use, and also a plant for the Freeport Spring Co., which is owned by the stockholders of the Hoefer Mfg. Co.

W. W. Griffin, Rosedale, Miss., has bought a site for a machine shop, and is now placing the material on the ground for its immediate erection.

The Krupp Foundry Co., recently incorporated at Lansdale, Pa., will erect a building 60x100 feet, with an annex 40x60 feet.

The Des Moines Bridge & Iron Works, Des Moines, Ia., have commenced the erection of the first of a number of permanent buildings planned for construction within the next two years. The first building to be erected will be of brick, fire proof, 82x100 feet. Other buildings to be erected later on will replace the temporary structures now in use, making the plant fire proof throughout.

Plans for improvement of the Panhandle shops at Dennison, O., have been approved. They provide for the removal of several of the old buildings, and the rebuilding of the entire plant, together with the erection of a three story office building.

The Pittsburg District:—

The Brown Hoisting Machinery Co., of Cleveland, Ohio. last week asked for an injunction to restrain members of the International Union of Bridge and Structural Iron Workers from interfering with their men employed at the Isabella furnaces of the American Steel Hoop Co., at Etna. The strike has been on for some time and the Brown Hoisting Machinery Co. alleges that a number of its employes have been enticed from their work and have been induced to leave the city. In the meantime work is being continued by non-union men, for whom an enclosure and boarding quarters have been built.

The Rotary Woven Wire Fence Co., of Pittsburg, has been organized with $300,000 capital for the purpose of erecting a wire fence plant at Columbus, Ohio. It is also the intention to erect a plant at Pittsburg in the near future. Adolf Boes has been elected president; G. Langer, vice president; G. Yaeger, secretary and treasurer.

The United States Hardware & Metal Corporation, which was recently incorporated under the laws of the State of Connecticut, is capitalized at $2,000,000, of which $1,000,000 the amount paid in is represented by 3,000 shares of the Bindley Hardware Co., of Pittsburg. The officers of the corporation are all Pittsburgers, as follows: John Bindley, president; E. Bindley, vice president; W. A. Bindley, secretary, and W. H. Cochran, treasurer.

Capt. Ilfred Hicks, president of the Allegheny Steel & Iron Co., has purchased the properties of the Saltsburg Coal Co., at Saltsburg, Pa., consisting of about 1,500 acres of land in Westmoreland and Indiana counties, Pa.

E. Dreifus, Trimble & Co., Arcade Bldg., Philadelphia, have opened an office in room 620, Lewis Bldg., Pittsburg. They will deal in pig iron and iron and steel scrap. In April the headquarters of the company will be removed to the Farmers' Bank Bldg.

The Pittsburg Engineering Co., which has existed for some time as a partnership, has completed a new organization and has been capitalized at $125,000, under the laws of New Jersey. The officers of the company are: G. P. Thurber, president; L. R. White, vice president; H. L. Kerr, secretary, and Joseph Stewart, treasurer.

The Humbert plant of the American Tin Plate Co., at Connellsville, Pa., was placed in full operation this week after an extended idleness. The plant contains six mills and has been idle since last July.

The Phillips Mine & Mill Supply Co., located on the South Side, Pittsburg, has completed the erection of additions to its plant which practically double the output. The main building added to the plant is three stories high and 100x120 feet. The operation of this addition will increase the output of cars from 50 to 100 daily.

General Industrial Notes:—

The E. Jenckes Mfg. Co., Pawtucket, R. I., recently incorporated, will manufacture knitting machines and light hardware. It will occupy a brick building 200x60 feet, three stories, which is now being erected for it by another company.

The Western Brass Mfg. Works, Chicago, have had no loss from fire recently and the report that they had was a false rumor.

McDowell, Stocker & Co., Chicago, agents for grinding and polishing machinery, whose building was recently damaged by fire, will rebuild and continue business at the same location. Temporarily, they are quartered at 68-70 S. Canal St., almost directly opposite the old location.

The McCleary Mfg. Co., London, Ont., which suffered from a disastrous fire in its stamping department Jan. 9, has shown great activity in resuming operations. The company had a vacant building and by utilizing it, has re-established the stamping department and is now turning out as large an output as before the fire.

The John Leisenring Mfg. Co., Philadelphia, has sold its machine shop with the keyseater stock, consigned goods and patents to the Mercury Machine Co., of that city, which will continue the manufacture of these goods in addition to its other work. Emmett R. Carter, who has been manager of the Leisenring Co., is the president of the new company.

The recent incorporation of the Grand Crossing Boiler Works Co. as successor of the Grand Crossing Boiler Works, Chicago, does not involve a change of ownership or policy.

The Buffalo Wire Works Co., Buffalo, N. Y., recently incorporated with a capital of $100,000, is the successor of Schuler's Sons, manufacturers of wire cloth and artistic metal work. The company has erected a new building, 50x100 feet, four stories, in which new machinery will be installed. A specialty will be metal work for banks and offices.

The Van Buren, Heck & Marvin Co., the consolidation of two concerns at Carey, O., and Findlay, O., has elected the following officers: C. J. Van Buren, president; George Carothers, vice president; Cloyd Marvin, secretary and treasurer; W. T. Heck, superintendent. Work has been commenced on the erecting room, which is 44x116 feet. The main office and works are located at Findlay. The tools and stock in Carey are being moved over to the Findlay plant as rapidly as possible. The plant will be equipped with pneumatic tools. Improved tools and machinery will be installed in all the departments. The product will be the Buckeye traction ditcher, the Field steam pump, oil feed pumping powers and glass house machinery. The company will start in with a force of 80 men, which will be rapidly increased as the season advances.

The Alabama Consolidated Coal & Iron Co. is now building a blast furnace at Gadsden, Ala., as previously noted in these columns. We are advised by the company that at this time it is not its intention to erect another furnace at Gadsden, or a rolling mill, as reported in daily newspapers.

President J. W. Duntley, of the Chicago Pneumatic Tool Co., says the annual statement of earnings will show fully 8 percent earned over and above the bond interest and a full year's dividend on the preferred stock. The annual meeting of the company is to be held Feby. 16 in Jersey City. No change in directors or officers is expected.

The American Bridge Co. has been awarded the contract for furnishing the steel for the addition to the Union Station at St. Louis, Mo., in preparation for the St. Louis Exposition. About 2,500 tons will be required.

The Auburn Nut & Bolt Works, near Pottsville, Pa., have been purchased by Philadelphia and Wilmington, Del., capitalists, and the name has been changed to the Delaware Seamless Tube Co.

The Buda Foundry & Mfg. Co., Harvey, Ill., has recently made an addition to its shop, and is putting in a new engine, and making other improvements.

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Lake Superior Iron Ore Shipments (Gross Tons)

NAME OF MINE.	Prior to 1887.	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	TOTALS.
Marquette Range.																		
American (Sterl'g)..	20,039	1,483	13,699	20,032	21,000	21,604	15,076	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	112,933
Barnum (B).....	702,682	16,123	10,211	12,835	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	801,851
Bessie	.....	.....	.....	.....	.....	847	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,007	5,854
Beaufort.....	77,388	12,829	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,583	4,338	59,781	155,919
Blue.....	.....	.....	.....	.....	.....	.....	.....	13,809	32,171	44,140	.....	2,519	.....	.....	.....	.....	.....	92,639
Boston	61,955	.....	.....	.....	.....	.....	.....	.....	.....	.....	587	.....	.....	.....	.....	.....	.....	62,542
Buffalo (A).....	10,860	24,686	30,801	50,919	100,464	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	217,730
Braastad { Mitch'l	116,126	16,419	4,091	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	136,636
Braastad { Wint'p.	515,248	74,067	86,789	155,341	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	831,445
Cambria.....	337,079	41,130	57,861	72,780	80,359	34,662	41,549	30,445	47,218	41,656	95,086	110,648	102,623	124,930	80,432	68,907	63,976	1,431,341
Champion.....	1,761,564	146,330	174,680	215,098	223,442	133,413	109,979	61,648	42,788	100,398	113,375	141,728	163,190	215,074	113,743	99,026	205,721	4,021,197
Chester	233,165	1,058	402	.....	.....	.....	.....	.....	.....	.....	.....	3,975	.....	.....	22,585	22,815	24,874	306,874
Cleve'd-Cliffs I. Co.	3,497,513	207,441	184,316	274,048	331,713	221,788	310,907	218,105	143,706	221,153	513,119	718,408	869,482	1011,048	881,021	860,484	1,104,864	11,569,116
Curry	.....	.....	.....	16,671	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,671
Detroit	80,050	26,099	18,500	10,112	6,080	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	140,841
Dexter.....	21,830	.....	1,821	3,895	9,136	5,448	13,000	7,833	21,740	13,752	18,903	1,154	.....	.....	.....	.....	.....	116,512
East Champion.....	73,305	.....	.....	2,697	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	76,002
East New York.....	.....	.....	13,694	29,739	36,431	50,293	35,175	911	.....	.....	.....	.....	.....	.....	27,987	31,686	38,761	264,687
Fitch	.....	.....	.....	.....	16,550	15,093	.....	.....	.....	* 174	.....	.....	.....	.....	.....	.....	.....	31,817
Foster (B).....	149,944	.....	.....	.....	21,949	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	171,893
Gibson	13,657	2,700	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,357
G'd Rapids (Davis).	.....	1,200	11,611	20,058	26,426	9,362	22,823	352	12,073	6,764	67	.....	.....	.....	.....	.....	7,440	110,736
Hartford.....	.....	.....	.....	566	.....	.....	5,678	6,513	.....	.....	1,532	.....	.....	.....	.....	.....	.....	21,729
Hortense(N.Ch'p'n)	.....	.....	886	5,685	7,757	16,246	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	30,574
Humboldt.....	626,561	19,873	11,655	15,866	23,259	19,879	4,571	.....	.....	.....	2,297	.....	.....	.....	.....	.....	.....	723,961
Iron Cliffs (K).....	.....	87,346	78,520	134,616	188,776	278,270	289,395	130,812	253,760	259,042	.....	.....	.....	.....	.....	.....	.....	1,700,537
Imperial	.....	.....	.....	.....	38,460	18,552	7,194	.....	.....	.....	.....	.....	.....	23,235	62,321	.....	.....	149,762
Jackson.....	2,604,545	109,906	101,909	128,891	124,682	92,979	92,567	51,009	32,298	42,186	80,710	79,102	55,012	88,230	31,714	38,271	15,449	3,769,463
Lake Angeline.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	304,125	304,125
Lake Superior.....	3,892,222	302,909	240,225	288,784	318,321	308,831	366,715	329,610	344,758	342,439	458,576	376,761	686,563	682,595	709,143	635,642	832,796	11,117,890
Lillie	121,509	23,041	32,692	33,916	31,812	19,551	29,005	68,861	78,388	54,245	107,532	112,781	211,023	196,200	114,990	98,788	79,919	1,414,293
Lucy (McComber)...	307,427	12,139	22,276	32,982	43,483	27,683	26,326	21,964	.....	.....	.....	10,033	11,846	.....	.....	.....	.....	516,159
Manganese.....	6,359	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6,359
Marquette (C).....	5,229	20,441	7,060	70,128	23,692	16,802	9,555	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	152,907
Mesabi's Friend....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,503	10,540	.....	.....	.....	.....	.....	.....	16,043
Michigamme (K)....	616,590	58,726	36,448	56,999	80,777	23,169	1,894	935	1,610	3,214	.....	.....	.....	.....	.....	.....	.....	880,362
Milwaukee	198,563	50,490	48,908	52,727	24,763	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	375,451
Moore	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,648	37,655	.....	42,303
Negaunee.....	.....	5,250	45,304	78,318	76,488	64,218	85,846	69,732	132,581	90,682	175,394	182,169	191,330	195,573	126,829	234,713	304,286	1,958,722
" Con. Wks.	12,708	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12,708
New York (York)...	1,035,001	5,128	.....	12,844	2,422	.....	11,220	25,000	21,487	.....	.....	.....	.....	6,642	3,327	.....	.....	1,123,071
N. Y. Hematite.....	37,587	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	37,587
Norwood.....	.....	2,200	3,553	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,753
Nonpareil (St. Law.)	21,959	1,436	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23,395
Pascoe.....	59,806	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59,806
Pendill	45,993	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45,993
Phenix (Dalliba)....	57,509	1,605	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	59,114
Pioneer	5,104	1,203	9,066	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15,409
Pitts. & L. Angel'e.	896,986	191,120	223,600	229,070	261,681	241,605	287,517	351,973	355,453	313,555	342,251	489,685	460,333	464,988	389,128	481,574	.....	5,990,519
Platt.....	.....	.....	.....	.....	.....	.....	2,676	5,448	41,226	13,198	11,296	.....	.....	.....	.....	.....	.....	73,844
Princeton (Sw'nz'y)	151,854	2,842	.....	.....	.....	7,301	29,403	19,096	.....	6,593	.....	.....	25,247	55,802	75,037	67,051	118,048	558,274
Queen	.....	.....	5,527	65,122	141,632	479,509	379,719	106,864	220,296	160,817	323,057	239,774	61,022	342,978	398,298	400,845	418,044	3,531,225
Republic.....	2,584,826	220,624	235,062	287,390	220,065	191,127	167,991	64,195	105,719	174,027	127,360	124,342	140,312	137,085	130,126	104,604	157,646	5,172,501
Repub. Reduc. Co..	.....	87	21,050	22,122	3,915	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47,174
Richmond.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,088	4,630	24,464	4,613	51,303	54,181	50,041	190,320
Riverside.....	.....	.....	5,622	3,712	.....	6,783	.....	43	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,160
Saginaw.....	447,104	.....	.....	.....	.....	4,320	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	451,424
Salisbury (B).....	404,913	48,304	74,947	72,449	85,798	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	686,411
Sam Mitchell.....	8,823	8,411	546	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17,780
Samson (Argyle).....	258,679	.....	4,512	2,796	1,218	.....	600	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	267,805
South Buffalo (A)..	.....	4,964	24,706	69,359	146,383	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	245,412
Spurr	164,244	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	164,244
Star West (Wheat)..	64,514	17,538	4,987	7,997	15,141	4,412	.....	.....	5,550	51,207	9,658	942	.....	6,716	15,987	.....	.....	204,649
Taylor	32,970	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	32,970
Titan.....	71,522	16,003	2,846	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	90,371
Volunteer	365,460	47,486	56,321	60,156	141,524	92,699	127,130	69,561	26,946	32,672	53,216	1,617	.....	29,983	47,578	.....	32,736	1,185,085
Webster	11,606	2,054	.....	448	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	20,797	.....	.....	34,905
West Republic.....	108,834	12,872	9,861	1,510	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	133,077
Wetmore	25,782	3,335	2,074	19,679	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50,870
Winthrop	.....	.....	.....	.....	109,576	122,042	191,658	180,071	134,365	119,120	150,496	106,894	122,592	171,318	148,945	109	129,496	1,570,135
Miscellaneous.....	*a* 364,736	*b* 1,841	*c* 289	*d* 1,384	.....	.....	.....	*e* 2,790	*f* 5,195	*g* 1,261	*h* 7,081	*i* 7,873	.....	.....	.....	.....	.....	392,450
Total	23,349,969	1851,634	1923,727	2642,813	2993,664	2512,242	2666,856	1835,893	2059,330	2097,838	2604,221	2715,035	3125,039	3757,010	3,457,522	3240,699	3,853,010	66,686,502
Mesabi Range.																		
Adams	.....	.....	.....	.....	.....	.....	.....	.....	.....	59,141	234,562	170,738	390,860	720,474	777,346	829,118	1,242,923	4,425,162
Aetna (Lowmore)...	.....	.....	.....	.....	.....	.....	.....	1,645	.....	.....	17,723	.....	.....	.....	.....	.....	196,316	215,684
Agnew.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	45,582	45,582
Auburn.....	.....	.....	.....	.....	.....	.....	.....	.....	108,210	376,970	131,478	175,263	235,630	385,992	263,692	427,510	38,283	2,143,028
Biwabik.....	.....	.....	.....	.....	.....	.....	.....	151,500	90,048	247,069	242,565	427,464	383,180	553,836	924,868	410,074	623,127	4,053,731
Canton	.....	.....	.....	.....	.....	.....	.....	24,416	213,853	359,020	16,261	.....	.....	99,498	.....	.....	.....	713,048
Chisholm	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	34,573	200,629	235,202
Cincinnati	.....	.....	.....	.....	.....	.....	.....	26,372	.....	17,187	57,324	32,912	.....	246	.....	.....	.....	134,041
Clark	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	63,071	199,566	350,799	613,436
Cloquet (Vega).....	.....	.....	.....	.....	.....	.....	.....	.....	5,628	47,700	96,280	12,215	.....	1,621	.....	.....	.....	163,444
Columbia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15,627	.....	15,627
Commodore	.....	.....	.....	.....	.....	.....	.....	65,137	7,213	.....	22,063	60,798	80,494	152,947	278,416	35,546	65,835	768,447
Corsica.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	26,838	59,292	86,130
Croxton	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18,594	18,594
Day.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18,651	1,975	.....	.....	106,516	127,142
Duluth	.....	.....	.....	.....	.....	.....	.....	37,626	.....	.....	.....	.....	112,155	165,435	128,587	150,024	150,220	744,047
Elba.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	564	9,547	121,707	224,630	207,454	563,902
Fayal.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	136,601	248,645	642,939	575,933	1072,257	1,252,504	1656,973	1,919,172	6,405,024
Franklin.....	.....	.....	.....	.....	.....	.....	.....	46,617	223,399	286,423	231,086	30,128	200,400	60,000	168,524	39,299	111,085	1,396,961
Genoa.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17,136	309,514	279,677	276,559	253,651	332,022	399,719	1,868,278
Glen.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	23,875	23,875
Grant.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	51,946	51,946
Hale.....	.....	.....	.....	.....	.....	.....	.....	3,616	24,167	31,004	70,006	13,728	.....	18,807	32,901	30,929	54,289	279,447
Hawkins.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,892	5,891
Jordan.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	147,931	147,931
Kanawha.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	14,963	64,218	41,300	24,829	145,310
Lake Sup. Group...	.....	.....	.....	.....	.....	.....	.....	.....	.....	58,123	67,659	259,912	135,404	154,326	284,023	594,761	766,311	2,320,519
La Belle	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	70,753	70,753
Laura.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	16,453	16,453
Leetonia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28,784	28,784
Lincoln	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	87,908	87,908
Longyear	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	22,788	22,788
Mahoning.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	117,884	167,245	519,892	520,751	750,341	911,021	765,872	1,038,645	4,791,651
Malta.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28,615	65,346	125,299	222,640	442,900
Minorca.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	35,499	35,499
Minnewas.....	.....	.....	.....	.....	.....	.....	.....	13,858	2,140	.....	.....	.....	.....	.....	.....	.....	.....	15,998
Morrow.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	35,571	35,571
Mtn. Iron (& Rath.)	.....	.....	.....	.....	.....	.....	4,245	119,813	573,440	371,274	142,021	773,538	650,955	1137,970	1,001,324	1058,160	1,421,456	7,254,201
Norman	.....	.....	.....	.....	.....	.....	.....	.....	38,999	93,392	77,523	101,077	110,141	.....	.....	.....	.....	421,132
Ohio.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28,043	69,925	47,350	101,607	293,651	172,597	.....	.....	714,073
Oliver (I)..	.....	.....	.....	.....	.....	.....	.....	123,015	505,955	509,377	808,291	601,072	349,100	.....	244,876	5,420	5,131	3,143,237
Pearce.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	54,884	54,884
Penobscot	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	11,933	29,652	85,619	146,641	221,080	209,531	704,456
Pettit.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17,278	17,278
Pillsbury	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	99,691	105,487	101,032	120,723	238,122	666,055
Roberts.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18,614	.....	57,847	41,966	42,756	28,972	190,154
Sauntry.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	53,004	68,560	328,739	249,837	700,140
Sellers.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47,433	153,037	.....	112,765	174,867	56,280	34,918	193,428	772,728
Sharon.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	56,810	224,526	281,336
Sparta.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	66,722	226,156	257,143	202,144	156,426	227,444	1,116,035
Spruce.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	101,675	279,515	543,203	924,393
Stevenson	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	56,031	666,273	1,434,681	2,156,985
Union.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8,297	93,109	103,522	204,928
Utica	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	9,009	9,009
Wills.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	12,158	12,158
Williams (N. Cin'ti)	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,046	11,249	.....	.....	12,357	18,238	.....	.....	44,890
Total	.....	.....	.....	.....	.....	.....	4,245	613,620	1793,052	2781,587	2882,079	4275,809	4613,766	6626,384	7,809,535	9004,890	13,342,840	53,747,807
Miscellaneous.....	2,320	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,320

A—Now Queen. B—Now Iron Cliffs. K—Under Cleve'd-Cliffs I. Co. after '95. I—Mesabi Mtn. and Lone Jack. C—1893 and later in Winthrop. D—Cherry Valley Ore. E—Include
a Bay State 16,637, Chicago 9,012, Columbia (Klomin) 94,813, Dey 2,709, Erie 8,136, Etna 1,091, Goodrich 49,754, National 150,216, Section 12, 21,887, Wheeling 10,486. *b* Iron Mountain 393, Richards
986, Richards 6,887. *c* Iron Chief No. 2, 551, Valley 1878. *d* First National 1,997.

NAME OF MI	
Menominee Ra	
Antoine.....	
Appleton.....	
Aragon.....	
Armenia	
Baltic	
Beta.....	
Breen	
Brier Hill.....	
Bristol (G).....	
Calumet.....	
Chapin.....	
Columbia.....	
Commonwealth	
Cornell.....	
Crystal Falls...	
Cuff	
Cundy	
Curry (F).....	
Cyclops (F).....	
Delphic	
Dober (H).....	
Dunn.....	
Emmett.....	
Ethel (Hennepi	
Fairbank.....	
Florence.....	
Foxdale ..	
Great Western..	
Groveland.....	
Half and Half..	
Hamilton.....	
Hemlock.....	
Hersel	
Hiawatha.....	
Hilltop	
Hollister	
Hope.....	
Indiana.....	
Iron River (H).	
Keel Ridge.....	
Lamont (Monit	
Lee Peck (D)...	
Lincoln.....	
Loretto.....	
Ludington.....	
Manganate.....	
Mansfield.....	
Mastodon.....	
Metropolitan ..	
Michigan Explo	
Millie (Hewitt)	
Monongahela...	
Nanaimo	
Northwestern..	
Norway (F).....	
Paint River....	
Penn Iron M'ng	
Perkins.....	
Perry.....	
Pewabic.....	
Quinnesec.....	
Riverton	
Selden.....	
Sheridan.....	
South Mastodon	
Stephenson.....	
Sturgeon River..	
Tobin	
Verona.....	
Vivian.....	
Vulcan (F).....	
Walpole.....	
Youngstown	
Total	
Vermilion Range	
Chandler.....	
Minnesota	
Pioneer	
Savoy (and Sible	
Zenith.....	
Total	
Gogebic Range.	
Ada.....	
Anvil.....	
Ashland.....	
Atlantic..	
Aurora	
Bessemer	
Blue Jacket.....	
Brotherton	
Cary and Superio	
Chicago.....	
Colby (E).....	
Eureka	
Federal.....	
Harm'ny (G'rm'ni	
Hennepin.....	
Imperial	
Iron Belt.....	
Iron Chief.....	
Ironton.....	
Jack Pot.....	
Kakagon.....	
Meteor (Comet)...	
Mikado.....	
Minnewawa.....	
Montreal.....	
New Davis.....	
Newport.....	
Nimisha.....	
Norrie	
Odanah.....	
Ottawa.....	
Pabst (J).....	
Palms.....	
Pence.....	
Pike.....	
Puritan (Ruby)...	
Section 33.....	
Shores	
Sparta.....	
Sunday Lake.....	
Superior.....	
Tilden	
Trimble.....	
Tyler's Forks....	
Upson	
Windsor.....	
Yale (West Colby)	
Miscellaneous.....	
Total	
GRAND TOTAL...	

5.	NAME OF MINE.	Prior to 1887	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	TOTALS.
	Menominee Range.																		
33	Antoine							4,377	5,618		27,981	110,821	98,847	104,510	93,025	119,940	65,429	110,993	728,496
51	Appleton										2,107								12,102
54	Aragon				1,745	46,609	96,829	167,948	127,901	138,209	183,296	95,809	149,594	295,821	337,807	404,645	477,212	646,303	3,169,628
19	Armenia				50,275	26,649					2,045						18,750	100,864	198,613
39	Baltic																17,326	64,664	81,990
42	Beta	1,585	1,226				1,400												4,211
30	Breen	17,430																	17,430
36	Brier Hill	14,981																	14,981
45	Bristol (G)							57,352	9,612										366,136
41	Calumet	38,713													80,915	51,639	36,593	129,035	38,713
27	Chapin	1,329,711	336,128	290,871	518,990	742,843	488,749	660,052	489,134	235,895	618,589	420,316	643,402	724,768	940,513	929,937	929,701	956,812	11,256,413
74	Columbia	41,338	2,377	10,936	11,385	60,133	70,770	57,682	22,426	10,300	70,967	87,202	24,623	14,199	126,290	97,531	19,963	186,798	914,820
6	Commonwealth	373,166	56,609	61,818	108,515	116,786	134,982	249,113	151,291	174,921	208,880	93,707	98,283	250,687	117,295	53,342	77,799	112,704	2,439,898
71	Cornell	47,236	2,064																49,302
11	Crystal Falls	1,341				3,974					13,037	44,526	95,210	128,233	147,346	197,770	220,614	195,555	1,057,606
2	Cuff														20,210	38,209		2,816	58,419
2	Cundy											3,595	41,942	76,877	100,902	141,148	178,800	183,052	726,116
7	Curry (F)	84,214		5,376	23,722	72,162	100,661	125,773											416,928
7	Cyclops (F)	231,345	14,297	14,693	6,101	7,361	10,599	1,697											286,093
3	Delphic	31,446	2,272									52							33,770
7	Dober (H)													5,009	10,980	49,203			65,192
5	Dunn		24,677	118,096	151,828	156,963	162,721	133,666	58,590	24,538	90,885	47,081	31,062	49,381	7,458			2,816	1,059,762
9	Emmett	66,655																	66,655
4	Ethel (Hennepin)																	14,455	14,455
1	Fairbank	8,500																	8,500
7	Florence	323,241	79,399	142,585	196,269	218,570	48,806	48,246	9,634	2,726	22,820	35,136	37,594	93,663	74,235	35,756	15,395	130,798	1,514,878
2	Foxdale																4,647	15,015	19,662
3	Great Western	66,389	23,239	21,860	38,454	72,546	62,464	87,487	661			14,643		33,851	43,316	98,550	123,261	42,470	729,191
4	Groveland						1,049										11,444	7,599	20,092
1	Half and Half				5,961	1,496	67												7,524
3	Hamilton	872	600	8,801	8,347	17,072	58,197	2,183											96,072
3	Hemlock						35,531	65,459	11,323		949	94,645	96,032	69,865	110,269	72,413	149,966	123,331	829,783
2	Hersel					955													955
2	Hiawatha								1,683		1,201					11,008	20,355	74,596	108,843
3	Hilltop														3,496	6,410	2,503		12,409
3	Hollister					2,020	1,057	1,021											4,098
3	Hope							15,543	2,275									3,373	21,191
3	Indiana	17,871																	17,871
3	Iron River (H)	316,352	83,018	110,000	179,238	155,458	59,345	1,176											904,587
3	Keel Ridge	59,465						5,997	3,298		19,441				4,900				93,101
3	Lamont (Monitor)				12,348	31,139	26,226	42,819	13,777	2,600					67,652	31,323		47,267	275,151
3	Lee Peck (D)							2,844											2,844
3	Lincoln						1,813	26,019	8,757						43,622	72,959	19,727	7,747	180,644
3	Loretto								8,131	55,983	53,160	34,334	54,104	68,447	64,824	61,219	54,985	128,300	583,487
3	Ludington	466,787	101,653	61,883	116,297	97,355	141,303	15,777	109	354									1,001,518
3	Manganate					6,844													6,844
3	Mansfield					18,303	49,836	69,259	69,558				37,782	60,739	86,607	90,155	74,113	31,181	586,933
3	Mastodon	93,618	48,792	51,463	63,511	66,526	45,370	9,150	23,485		23,733	60							425,708
3	Metropolitan	94,467	9,070	3,490															107,027
3	Michigan Explo.Co.								505	77	1,071		216					53,272	55,141
3	Millie (Hewitt)	39,439	1,163	11,124	12,274	39,232	5,889	6,780		13,062	10,924	21,815	10,374	17,430	15,194	14,922	12,133	25,935	257,690
3	Monongahela																2,397		2,397
3	Nanaimo	74,721	30,460	5,744		3,441	13,290												127,566
3	Northwestern	17,206																1,324	18,530
3	Norway (F)	929,749	95,726	87,260	68,044	61,717	4,089	44,767											1,291,352
3	Paint River	40,446	10,240	12,506	32,700	62,654	45,435	18,390											234,070
3	Penn Iron M'ng Co.								280,450	175,274	280,622	179,917	237,886	223,713	228,651	197,606	358,126	273,443	2,446,698
3	Perkins	342,221	10,834	16,684	12,354	11,971					2,161								397,225
3	Perry	3,138																	3,138
3	Pewabic					26,991	64,507	115,273	165,745	304,010	262,551	272,587	279,855	305,072	530,129	374,043	507,780	539,291	3,739,840
3	Quinnesec	274,489	6,585	2,249							761				11,050	25,967	62,383	62,531	450,015
3	Riverton														2,262	71,004	119,860	215,850	408,976
3	Selden	790	1,302																2,092
3	Sheridan				1,102	595	7,137	45,745	2,234		16,754	3,419	146		31,104	8,063			116,299
3	South Mastodon			2,722	4,005	1,476													8,203
3	Stephenson	35,761	3,589																39,350
3	Sturgeon River		6,829	7,800	4,775														18,404
3	Tobin																18,957	55,238	74,195
3	Verona															5,143	11,475	43,245	59,863
3	Vivian																	40,384	40,384
3	Vulcan (F)	816,300	205,036	129,541	153,900	104,996	78,967	179,904											1,668,654
3	Walpole		1,740	900	9,614	2,940	3,895												19,089
3	Youngstown	55,469	34,418	12,699		44,460	3,705				13		661						151,425
	Total	6,556,464	1193,343	1191,101	1796,754	2282,237	1824,619	2261,499	1466,197	1137,949	1,923,798	1,560,467	1,937,013	2,522,265	3,301,052	3,261,221	3,623,730	4,627,524	42,267,233
	Vermillion Range.																		
3	Chandler			454,612	306,220	336,002	373,969	651,655	435,930	558,050	605,024	471,545	438,365	715,919	808,359	644,801	627,379	645,786	7,673,616
3	Minnesota	592,004	394,252	57,341	535,318	532,000	517,570	498,353	370,303	390,463	432,760	448,707	592,196	426,040	457,732	325,020	208,284	275,168	7,453,511
3	Pioneer				3,144	12,012	3,079	2,651			40,054	149,073	207,103	123,183	339,897	450,794	678,310	673,863	2,683,163
3	Savoy (and Sibley)														86,191	175,116	212,008	322,241	795,556
3	Zenith							14,991	14,388			18,765	40,817		79,323	60,089	60,082	167,206	455,660
	Total	592,004	394,252	511,953	844,682	880,014	894,618	1167,650	820,621	948,513	1,077,838	1,088,090	1,278,481	1,265,142	1,771,502	1,655,820	1,786,063	2,084,263	19,061,506
	Gogebic Range.																		
3	Ada														7,977	25,047		8,555	41,579
3	Anvil		10,075	24,676	47,000	45,690	73	42,090		13,297	68,064	57,483		5,037			1,101	135,592	450,088
3	Ashland	80,756	175,563	174,183	257,915	435,949	267,439	231,896	66,067	83,020	126,096	91,149	111,625	123,208	154,615	232,961	286,399	301,824	3,200,665
3	Atlantic		1,369								70,989	60,727	50,307	38,058	19,964	135,955	190,135	190,213	757,717
3	Aurora	99,975	159,252	179,937	199,865	246,695	83,554	319,482	179,028	203,152	245,883	187,169	166,122	133,076	170,369	193,111	223,747	402,981	3,393,398
3	Bessemer	4,788	16,101																20,889
3	Blue Jacket		1,799																1,799
3	Brotherton	8,880	21,721	40,639	53,267	80,486	46,574	130,833	18,905	47,148	40,567	50,490	46,186	73,196	78,858	89,894	103,109	53,255	983,920
3	Cary (and Superior)				56,542	116,203	121,186	106,484	28,578	16,559	52,349	38,821	37,308	43,162	62,524	125,496	179,374	136,895	1,121,481
3	Chicago											504				633		44,625	42,762
3	Colby (E)	342,756	258,518	285,880	136,833	193,038	9,619	69,968	59,346	32,616		48,492	22,921	152,875	163,239	32,572	23,475	22,826	1,794,674
3	Eureka					23,794	13,907	10,655	31,385	18,329	26,105	4,544							128,719
3	Federal					21,150	6,778												27,928
3	Harm'ny (G'rm'n'a)	25,202	61,714	52,918	103,169	52,000	22,383	4,283	7,964				1,015			986	10,358	20,502	363,494
3	Hennepin			28,721	76,545	63,903	15,759									7,728	21,475	36,383	250,514
3	Imperial							8,515											8,515
3	Iron Belt			30,000	51,551	110,368	1,506	161,635	23,976	45,109	148,228	81,351	96,763	58,418	105,934	54,664	43,883	79,121	1,092,507
3	Iron Chief	9,959	2,249																12,199
3	Ironton	18,424	24,762		8,835	6,247	300											8,555	66,923
3	Jack Pot							3,944	1,651				1,265			33,893	19,988	102	61,843
3	Kakagon	18,497	52,179	1,228															71,904
3	Meteor (Comet)					2,882	10,144	54,779	9,604	11,782					332	7,844	34,140	19,117	150,624
3	Mikado										4,788		11,397		10,324	1,090	91,846	98,834	218,279
3	Minnewawa														1,255				1,255
3	Montreal	23,013	43,989	38,015	42,724	16,728	70,108	58,728	34,299	46,037	138,882	131,531	191,106	270,776	153,307	107,524	72,945	136,354	1,576,066
3	New Davis					1,497		21,754	15,210		10,253				5,029	3,569		31,530	88,842
3	Newport	20,184	75,660	69,145	36,987	71,488	105,606	165,962	109,718	150,392	157,821	142,369	150,979	196,953	283,711	217,201	190,448	141,571	2,266,195
3	Nimikon	4,105	23,217	1,313															28,635
3	Norrie	140,263	237,254	412,196	674,394	906,728	758,572	985,216	472,062	621,608	738,490	329,068	604,281	700,990	714,669	666,389	660,965	1,080,032	10,703,167
3	Odanah	13,714	30,475	5,412	13,354	1,065		6,711	3,956	2,437									77,124
3	Ottawa																	26,141	26,141
3	Pabst (J)	19,082	19,906	49,976	116,376	172,060	130,226	113,245	104,510	206,074	219,980	68,984	220,496	223,891	263,869	239,242	198,686		2,366,583
3	Palms		1,414	9,725	35,245	50,604	32,227	102,382	2,658	37,911	46,965	114,108	207,153	175,925	154,705	139,658	7,603	32,113	1,150,396
3	Pence			26,687	574							13,185	120						40,566
3	Pike															3,434	6,346	6,343	16,123
3	Puritan (Ruby)	16,388	45,000	3,058	9,472	11,694	913										21,788		108,313
3	Section 33				73,370	126,963	38,576	14,681											253,590
3	Shores											12,196	16,102	15,691	11,819				55,808
3	Sparta							2,912			1,950							11,065	4,862
3	Sunday Lake	12,368	18,137			6,010	64,902	56,046	22,876	34,323	20,970	89,441	45,815		12,526	74,097	89,997	144,630	692,138
3	Superior	2,690	27,763			36,675	10,710	13,192		30,597									121,627
3	Tilden						28,415	233,356	135,118	209,077	418,188	250,206	276,890	287,203	500,830	481,909	446,670	468,672	3,736,533
3	Trimble	10,780	12,764	2,387															25,931
3	Tyler's Forks					10,683													10,683
3	Troop																	11,065	11,065
3	Windsor				14,576	37,210	97	53,242	2,474		11,438	28,154	385			488	841		148,905
3	Yale (West Colby)																12,836	26,043	38,879
	Miscellaneous	*f* 4,429	*k* 1,997																6,426
	Total	874,244	1322,878	1437,096	2008,394	2847,810	1839,574	2971,991	1329,385	1809,468	2,547,976	1,799,971	2,258,236	2,498,461	2,795,856	2,875,295	2,938,155	3,663,484	37,818,274
	GRAND TOTAL	31,175,001	4762,107	5063,877	7292,643	9003,725	7071,053	9072,241	6065,716	7748,312	10,429,037	9,934,828	12,464,574	14,024,673	18,251,804	19,059,393	20 593 537	27,571,121	219583,642

e. E—Includes Tilden up to 1891. F—1893 and later under Penn Iron Mining Co. G—Formerly Claire. H—Now Riverton. J—Under Norrie after 1901.
ain 92, Richards 1,374, Wheeling 74. *c* N. Republic 289. *d* Edison 893, Quarts 491. *e* Ames 1,103, Northwest 1,687. *f* Ames 5,195. *g* Schadt 1,261. *k* Palmer 1,041, Primrose 6,040. *i* Ogden